CIVIL ENGINEERING ASSISTANT

NSQF LEVEL - 4

1st Year

TRADE PRACTICAL

SECTOR: CONSTRUCTION

(As per revised syllabus July 2022 - 1200 Hrs)

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Directorate General of Training

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MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
GOVERNMENT OF INDIA

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

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Duration : **2 Year**

Trade : **Civil Engineering Assistant - 1st Year - Trade Practical - NSQF Level - 4 (Revised 2022)**

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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 **Civil Engineering Assistant - 1st Year Trade Practical NSQF Level - 4 (Revised 2022) in Construction Sector.** The NSQF Level - 4 (Revised 2022) Trade Practical 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 - 4 (Revised 2022) trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF Level - 4 (Revised 2022) 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 Director General, Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

ATUL KUMAR TIWARI, *I.A.S*
Secretary
Ministry of Skill Development & Entrepreneurship,
Government of India.

April 2024
New Delhi - 110 001

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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 syllabus (NSQF Level - 4) under the Craftsman and Apprenticeship Training Schemes.

The instructional materials are created keeping in mind, the main objective of Vocational Training under NCVET/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.

In order to perform the skills in a productive manner instructional videos are embedded in QR code of the exercise in this instructional material so as to integrate the skill learning with the procedural practical steps given in the exercise. The instructional videos will improve the quality of standard on practical training and will motivate the trainees to focus and perform the skill seamlessly.

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.

Chennai - 600 032 **EXECUTIVE DIRECTOR**

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National Instructional Media Institute (NIMI) sincerely acknowledges with thanks for the co-operation and contribution extended by the following Media Developers and their sponsoring organisations to bring out this Instructional Material **(Trade Practical)** for the trade of **Civil Engineering Assistant - 1st Year** (NSQF Level - 4) (Revised 2022) under **Construction** Sector for ITIs.

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NIMI records its appreciation for the Data Entry, CAD, DTP operators for their excellent and devoted services in the process of development of this Instructional Material.

NIMI also acknowledges with thanks the invaluable efforts rendered by all other NIMI staff who have contributed towards the development of this Instructional Material.

NIMI is also grateful to everyone who has directly or indirectly helped in developing this Instructional Material.

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INTRODUCTION

TRADE PRACTICAL

This manual for trade practical is intended for use in the ITI workshop. It consists of a series of practical exercises that are to be completed by the trainees during the first semester of course is the **Civil Engineering Assistant** trade under **Construction** Sector. It is National Skills Qualifications Framework **NSQF (Level - 4)** supplemented and supported by instructions/information to assist the trainees in performing the exercise. The exercises are designed to ensure that all the skills prescribed in the syllabus are covered including the allied trades.The syllabus for the1st Year **Civil Engineering Assistant** Trade under **Construction Sector** Trade Practical is divided into Ten Modules.The allocation of time for the various modules is given below:

Module 1 - **Safety**

Module 2 - **Basic engineering drawings**

Module 3 - **Building Materials - I**

Module 4 - **Auto CAD**

Module 5 - **Building materials - II**

Module 6 - **Building construction**

Module 7 - **Survey**

Module 8 - **Carpentry**

Module 9 - **Electrical wiring**

Module 10 - **Plumbing work**

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

While developing the practical manual a sincere effort was made to prepare each exercise which will be easy to understand and carry out even by below average trainee. However the development team accept that there is a scope for further improvement. NIMI, looks forward to the suggestions from the experienced training faculty for improving the manual.

TRADE THEORY

The manual of trade theory consists of theoretical information for the course of the **Civil Engineering Assistant 1st Year**, NSQF Level - 4 (Revised 2022) in **Construction** Sector. 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 co-relation 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 on trade practical. The indicating about the corresponding practical exercise are given in every sheet of this manual.

It will be preferable to teach/learn the trade theory connected to each exercise atleast one class before performing the related skills 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.

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CONTENTS

Exercise No.	Title of the Exercise	Learning Outcome	Page No.
	Module 1 : Safety		
1.1.01	Importance of trade training and demonstrate tools, equipments and uses		1
1.1.02	Importance of housekeeping and good shop floor practice		7
1.1.03	Occupational safety and Health		8
1.1.04	Disposal procedure of waste materials of the trade		17
1.1.05	Personal protective equipment (PPE): Basic injury prevention		18
1.1.06	Hazard identification and avoidance, safety signs		20
1.1.07	Electrical safety preventive measure for electrical accidents and practice steps to be taken in such accidents		23
1.1.08	Use of fire extinguishers		25
	Module 2 : Basic Engineering Drawing		
1.2.09	Awareness of the job sheet made by the Ex-trainees		28
1.2.10	Use of drawing instrument and equipment with care (line, angle and patterns)		30
1.2.11 & 12	Method of fixing drawing sheet and folding of drawing sheet		33
1.2.13	Draw free hand sketch of hand tools used in civil work	1	35
1.2.14	Symbols and conventional representation for materials in sections as per IS 962 - 1989 - SP 46: 2003 for building drawings		36
1.2.15	Draw types of Lines, lettering and numbering and dimensioning techniques as per IS 962- 1989, SP- 46:2003	2, 3, 4	42
1.2.16	Construction of plain geometrical figures		45
1.2.17	Construction of scales - plain , comparative , diagonal , vernier scale and of chords		49
1.2.18	Drawing of Construction of solid geometrical figures		52
1.2.19	Three views in orthographic projection of solid object and section of solids		53
1.2.20	Isometric, oblique and perspective views of geometrical solids	5	58
	Module 3: Building Materials - I		
1.3.21	Drawing of component parts of a single storied residential building (in sectional details)	6	65
	Module 4: Auto CAD		
1.4.22	Function of keys and practice of basic commands		66
1.4.23	Use of Elementary commands by CAD, tool bar		72
1.4.24	Creation of object in different layers on CAD workspace	7	100
1.4.25	Plotting of drawing from CAD		105
1.4.26	2D drafting of flush door, paneled door, window, hand railing, wash basin, sewerage pipe joints using CAD		120
1.4.27	Preparing library folder by creation blocks of prepared drawings		121
1.4.28	Bar bending schedule		122
	Module 5: Building Materials - II		
1.5.29	Identify different types of bricks and hollow bricks, uses		127
1.5.30	Identify Different types of stones masonry and uses		128
1.5.31	Identify different types of tiles and uses		131

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Exercise No.	Title of the Exercise	Learning Outcome	Page No.
1.5.32	Identify different types of cement and uses, field test of cement	8	134
1.5.33	Identify different types of sand, aggregate and uses		136
1.5.34	Identify different types of lime and uses		137
1.5.35	Identify different types of steel and uses		138
1.5.36	Identify different types of timber and earthenware and uses		139
	Module 6: Building Construction		
1.6.37	Setting out a building - obtaining first, second, third and fourth lines marking diagonals, setting out cross walls and offsets	9	141
1.6.38&39	Marking excavation lines and fixing of plinth and floor levels and Set out foundation trench		149
1.6.40	Demonstrate the use of brick masonry tools	10	152
1.6.41	Different types of brick bonding		155
1.6.42	Make scaffolding and prepare surface for plastering	11	158
1.6.43	Perform plastering operation on different surfaces		160
1.6.44	Perform rendering and wall cladding		163
1.6.45	Perform application of cement paint on different surfaces	12	166
1.6.46	Perform application of plastic emulsion on different surfaces		167
1.6.47	Perform application of enamel paint on different surfaces		168
1.6.48	Perform application Process of varnishing	13	169
1.6.49	Perform on laying of D.P.C and materials		170
1.6.50	Flooring practice determination and formation of slope, application of slurry for finishing, setting out of skirting, formation of spots for skirting	14	173
1.6.51	Use of screeds, formation of curve at junction of skirting and floor		175
	Module 7: Survey		
1.7.52	Practice on unfolding, stretching and folding of metric chain	15	176
1.7.53	Ranging (direct/ indirect) and distance measure with chain/ tape		177
1.7.54	Practice in offsetting and entering field book		179
1.7.55	Practice chaining on sloping ground		183
1.7.56	Practice on chain survey a small area with all details and plotting the map		184
1.7.57	Calculating the area of site		185
1.7.58	Prepare a site plan with the help of chain/ tape		186
1.7.59	Temporary adjustment of prismatic compass		187
1.7.60	Determine the fore bearing and back bearing of a given line AB		188
1.7.61	Measure true bearing of the line		189
1.7.62	Prepare a closed and open traverse using primatic compass	16	190
1.7.63	Demonstration of instrument used for plane table surveying and their uses (alidade, U fore, trough compass) Set up the plane table		192
1.7.64	Practice the method of plane tabling by radiation intersection, resection & traversing		194
1.7.65	Determination of height by telescopic alidade	17	196
1.7.66	Handling and practice of levelling instruments and their settings		197
1.7.67	Temporary adjustments of level		199
1.7.68	Simple levelling		201
1.7.69	Differential levelling (fly levelling)		202

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Exercise No.	Title of the Exercise	Learning Outcome	Page No.
1.7.70	Carryout levelling in field book		203
1.7.71	Equate reduction of level (Rise and fall method and height of collimation method) comparison of method		204
1.7.72	Solve problems on reduction of levels		206
1.7.73	Calculate missing data and filling calculations and arithmetical check in levelling survey		208
1.7.74	Practice levelling with different instruments		210
1.7.75	Check levelling		210
1.7.76	Longitudinal levelling or profile levelling and plotting		211
1.7.77	Surveying of a building site with chain and Levelling Instrument with a view to computing earth work		213
1.7.78	Contour - direct & indirect methods		215
1.7.79	Make topography map, contours map		216
1.7.80	Trigonometric levelling - base of the object accessible (object vertical)		218
1.7.81	Prepare a road project (open traverse)	18	220
1.7.82	Field work of theodolite		222
1.7.83	Measuring a horizontal angle (ordinary method) vertical angle, magnetic bearing of a line		223
1.7.84	Levelling with a theodolite (simple levelling)		227
1.7.85	Calculation of area from traverse		228
1.7.86	Determination of height		229
1.7.87	Calculate of departure, latitude, northing and easting		231
1.7.88	Setting out work for building work etc	19	233
1.7.89	Application of survey using total station		234
1.7.90	Field procedure for co-ordinate measurement		236
1.7.91	Field procedure to run open traverse and closed traverse		238
1.7.92	Establishment of bench mark		241
1.7.93	Perform stake out / demarcation of building layout /plot layout/ roads/ alignment		243
1.7.94	Measure remote distance and elevation		246
1.7.95 & 96	Calculate surface area and volume on field/site		247
1.7.97	Procedure for download & up load data		248
1.7.98	Simple survey map using Auto CAD	20	251
	Module 8: Carpentry		
1.8.99	Identification of different wooden sample pieces for hard wood, softwood, grains and their applications		252
1.8.100	Demonstrate use of carpentry hand tools, measuring and work holding devices and their applications		255
1.8.101	Demonstrate use of different power tools for saws, and drills		257
1.8.102	Perform sawing, planning,moulding rebating chamfering		258
1.8.103	Sharpening and setting of saw blade and planer blade		261
1.8.104	Planning face side and face edge	21	263
1.8.105	Demonstrate the use of marking gauge and mortise gauge		264
1.8.106	Test the accuracy of flatness and twistness of the surface by using try square		265
1.8.107	Demonstrate the use of winding strips, cross planning and edge planning		266

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Exercise No.	Title of the Exercise	Learning Outcome	Page No.
1.8.108	Demonstrate the portable power planer machine and its function		267
1.8.109	Single and double mortise and tenon joint, plain hunched corner mitre joint	22	268
1.8.110	Full housing, stopped housing joint and bridle joint		272
1.8.111	Simple butt joint and rebate joint		275
1.8.112	End half lap, end over lap and end bevel lap joint, scarf joint and table scarf joint with wedges	23	277
1.8.113-115	Make small wall bracket	24	281
1.8.116	Make different types doors including paneled, glazed door		284
1.8.117	Make window frame and window shutter	25	287
	Module 9 : Electrical wiring		
1.9.118	Prepare terminations of cable ends		291
1.9.119	Practice on skinning, twisting and crimping		293
1.9.120	Identify various types of cables and measure conductor size using SWG and micrometer		295
1.9.121	Make simple twist, married, Tee and western union joints		297
1.9.122	Make britannia straight, britannia 'T' (Tee) and rat tail joints		300
1.9.123	Practice in Soldering of joints/lugs		302
1.9.124	Demonstrate different electrical wiring system with different accessories	26	304
1.9.125	Make electrical fuse joints, fixing MCB		306
1.9.126	Connect lamps with switches		307
1.9.127&128	Staircase circuit wiring and godown wiring		308
1.9.129	Hospital wiring		309
1.9.130	Install earthing in different position		310
1.9.131	Install and connect electrical appliances and take reading with voltmeter	27	312
1.9.132	Prepare a materials list and costing of wiring	28	313
1.9.133	Identify transformer, test and use	29	316
	Module 10 : Plumbing work		
1.10.134	Perform simple pipe connection using G.I pipes with G.I fittings		318
1.10.135	Layout of soil pipe and waste pipe in storied building		320
1.10.136	Fitting of I.W.C with high level cistern		322
1.10.137	Fitting of wash basin		323
1.10.138	Fitting of E.W.C with low level cistern		324
1.10.139	Fitting of kitchen sink		325
1.10.140	Fitting of bath tub		326
1.10.141	Fitting of urinal pot with cistern	30	327
1.10.142	Installing water meter	31	328
1.10.143	Removal of air locks		329
1.10.144	P.H meter - treatment of effluent water		330
1.10.145	Recondition (repairing) caps, valves & flushing tank		331
1.10.146	Preparing a water supply system in a residential building	32	335
1.10.147	Different objects on 3D modelling concept in CAD	33	336

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LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

S.No	Learning Outcome	Ref. Ex.No.
1	Prepare free hand sketches of hand tools used in civil work with proper layout and folding of drawing sheets following safety precaution. (Mapped NOS: PCS/N9446)	1.1.01 - 1.2.13
2	Prepare Symbols, Lettering, Numbering, plane figure applying drawing instruments and practice dimensioning Technique as per BIS. (Mapped NOS: PCS/N9447)	1.2.14 - 1.2.16
3	Construct plain scale, comparative scale, diagonal scale and vernier scale (Mapped NOS: PCS/N9448)	1.2.17
4	Draw orthographic projections of different objects with proper lines and dimensioning. (Mapped NOS: PCS/N9449)	1.2.18 & 1.2.19
5	Draw Isometric, oblique and perspective views of different solid, hollow and cut sections with proper lines and dimensions as per standard convension. (Mapped NOS: PCS/N9450)	1.2.20
6	Draw component parts of a single storied residential building with suitable symbols and scales. (Mapped NOS: PCS/N9451)	1.3.21
7	Create objects on CAD workspace using Toolbars, Commands, Menus, formatting layer and style. (Mapped NOS: PCS/N9452)	1.4.22 - 1.4.28
8	Identify different types of building materials i.e. Stones, Bricks, Lime, Pozzolanic, Cement, Sand, Clay Products, Mortar their characteristic, types, use & function. (Mapped NOS: PCS/N9453)	1.5.29 - 1.5.36
9	Mark different types of Foundation and Set out Foundation trenches. (Mapped NOS: PCS/N9454)	1.6.37 - 1.6.39
10	Demonstrate different types of brick masonry and Tools used in different bonds. Perform construction of wall - header bond, stretcher bond, English bond, Flemish bond. (Mapped NOS: PCS/N9455)	1.6.40 & 1.6.41
11	Perform different types of Plastering & Pointing, rendering & wall cladding. (Mapped NOS: PCS/N9456)	1.6.42 - 1.6.44
12	Identify different types of Protective materials i.e. Paint, Varnish and their application. (Mapped NOS: PCS/N9457)	1.6.45 - 1.6.48
13	Demonstrate Damp Proof Course in different position. (Mapped NOS: PCS/N9458)	1.6.49
14	Prepare different types of Flooring (Mapped NOS: PCS/N9459)	1.6.50 & 1.6.51
15	Perform site survey with Chain/Tape and prepare the site Plan. (Mapped NOS: PCS/N9460)	1.7.52 - 1.7.58
16	Perform the site survey using Prismatic Compass. (Mapped NOS: PCS/N9461)	1.7.59 - 1.7.62
17	Perform site survey with Plane Table and prepare a map. (Mapped NOS: PCS/N9462)	1.7.63 - 1.7.65
18	Prepare topography map by contours with levelling instruments. (Mapped NOS: PCS/N9463)	1.7.66 - 1.7.81
19	Perform a site survey with Theodolite and prepare site plan. (Mapped NOS: PCS/N9464)	1.7.82 - 1.7.88
20	Perform a site survey with Total Station and prepare site plan. (Mapped NOS: PCS/N9465)	1.7.89 - 1.7.98

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LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

S.No	Learning Outcome	Ref. Ex.No.
21	Identify timber and perform sawing and planning using hand and power tools. (Mapped NOS: MIN/ N0454)	1.8.99 - 1.8.103
22	Demonstrate surface finish with exact sizing by planning operation. (Mapped NOS: MIN/ N0454)	1.8.104 - 1.8.108
23	Prepare different wooden Joints. (Range of skill - framing joint, Housing joints, broadening joints, Lengthening joints). (Mapped NOS: MIN/ N0454)	1.8.109 - 1.8.112
24	Make small wooden job as per drawing with schedule sizes of timber or alternatives of timber i.e. FRP, MDF, FOAM using various hardware. (Mapped NOS: PCS/N9466) ‘	1.8.113 - 1.8.115
25	Make different types of doors and windows with fixing of component. (Mapped NOS: PCS/N9467)	1.8.116 - 1.8.117
26	Demonstrate joining of electrical wire and carry out soldering, crimping observing related safety precautions. (Mapped NOS: MIN/N3102)	1.9.118 - 1.9.123
27	Demonstrate Electrical wiring with fixing of accessories conforming ISI rules (Range of skills - different types of Electrical wiring, joining of Fuses, fixing of MCB, connection of lamp with switch and different fitting, etc.). (Mapped NOS: MIN/N3102)	1.9.124 - 1.9.129
28	Demonstrate installation of electrical appliances, Earthing and estimate costing of wiring. (Mapped NOS: MIN/N3102, MIN/N3104, MIN/N3102)	1.9.130 - 1.9.132
29	Identify different type of transformers and test and use. (Mapped NOS: MIN/N3101, MIN/N3102, MIN/N3103)	1.9.133
30	Prepare a Simple pipe connection demonstrating cutting, joining of pipe with different method using different types of fittings. (Mapped NOS: MIN/ N3208)	1.10.134
31	Prepare layout of soil pipe and waste pipe with different types of sanitary fittings. (Mapped NOS: PCS/N9468)	1.10.135 - 1.10.141
32	Prepare a water supply system in residential buildings using different types of valves, fittings and appliances. (Mapped NOS: PCS/N9469)	1.10.142 - 1.10.146
33	Create objects on 3D Modelling concept in CAD (Mapped NOS: PCS/N9470)	1.10.147

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SYLLABUS

1st Year **Duration: Two years**

Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With indicative hour)	Professional Knowledge (Trade Theory)
Professional Skill 18 Hrs; Professional Knowledge 04 Hrs .	Prepare free hand sketches of hand tools used in civil work with proper layout and folding of drawing sheets following safety precaution. (Mapped NOS: PCS/ N9446)	1. Importance of trade training, demonstrate tools & equipments used in the trade. (1 hrs) 2. Importance of housekeeping & good shop floor practices. (1 hrs) 3. Occupational Safety &Health :Introduction to safety equipments and their uses. Introduction of first aid. Health, Safety and Environment guidelines, legislations & regulations as applicable. (2 hrs) 4. Disposal procedure of waste materials of the trade. (1 hrs) 5. Personal protective Equipments(PPE):-Basic injury prevention, Basic first aid. (1 hrs) 6. Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. (1 hrs) 7. Preventive measures for electrical accidents&steps to be taken in such accidents. (2 hrs) 8. Use of Fire extinguishers. (1 hrs.)	Importance of safety and general precautions observed in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills: its importance and Job area after completion of training. Introduction of First aid. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies e.g.; power failure, fire alarm, etc. (02 hrs)
		9. Awareness about the job sheets made by the ex. trainees. (1 hrs) 10. Use of drawing instruments and equipment with care. (1 hrs) 11. Method of fixing of drawing sheet on the drawing board. (1 hrs) 12. Layout of different size of Drawing sheets and folding of sheets. (2 hrs) 13. Draw free hand sketch of hand tools used in civil work.(3 hrs)	• Familiarisation& information about rules and regulations of the Institute and Trade. • Overview of the subjects to be taught for each year. • List of the Instruments, equipments and materials to be used during training. (04 hrs)
Professional Skill 15 Hrs; Professional Knowledge 06 Hrs	Prepare Symbols, Lettering, Numbering, plane figure applying drawing instruments and practice dimensioning Technique as per BIS. (Mapped NOS: PCS/ N9447)	14. Symbols &conventional representation for materials in sections as per IS 962-1989, SP46:2003 for building drawings. (04 hrs) 15. Draw types of Lines, lettering and numbering as per IS 962- 1989, SP- 46:2003. (05 hrs) 16. Construction of plain geometrical figures. (06 hrs)	• Importance of B.I.S. • Introduction of Code for the practice of Architectural and Building Drawings (IS: 962-1989, SP-46:2003). • Layout of drawing. Lines, Lettering, Dimensioning. (06 hrs)

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Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With indicative hour)	Professional Knowledge (Trade Theory)
Professional Skill 20 Hrs; Professional Knowledge 04Hrs	Construct plain scale, comparative scale, diagonal scale and vernier scale (Mapped NOS: PCS/ N9448)	17. Construction of scales – Plain, comparative, diagonal, vernier & scale of cords. (20 hrs)	• Knowledge of different types of scale. Principle of R.F. (04 hrs)
Professional Skill 22 Hrs; Professional Knowledge 10Hrs	Draw orthographic projections of different objects with proper lines and dimensioning. (Mapped NOS: PCS/ N9449)	Drawing of :- 18. Construction of solid geometrical figures. (10 hrs) 19. Three views in Orthographic Projection of Solid objects & section of solids. (12 hrs)	• Different types of projection views: Orthographic, Isometric, Oblique and Perspective. (10 hrs)
Professional Skill 28 Hrs; Professional Knowledge 06 Hrs	Draw Isometric, oblique and perspective views of different solid, hollow and cut sections with proper lines and dimensions as per standard convension. (Mapped NOS: PCS/ N9450)	20. Isometric, oblique and perspective views of geometrical solids, hollow and cut sections. (28 hrs)	Theory of perspective view (06 hrs)
Professional Skill 28 Hrs; Professional Knowledge 04 Hrs	Draw component parts of a single storied residential building with suitable symbols and scales. (Mapped NOS: PCS/N9451)	Drawing of :- 21. Component parts of a single storied residential building. (in sectional details) Showing Foundation, Plinth, Doors, Windows, Brick work, Roof, Lintel and Chajjah, Arches, etc. (28 hrs)	Building materials:- • Timber:- Types, Structure, disease & defects, characterstic, seasoning, preservation and uitility. • Alternative material to Timber • Plywood, Block board, Particle board, fibre reinforced plastic (FRP), Medium density fireboard (MDF) etc. • Tar, bitumen, asphalt: Properties, application and uses.(04 hrs)]
Professional Skill 114 Hrs; Professional Knowledge 04 Hrs	Create objects on CAD workspace using Toolbars, Commands, Menus, formatting layer and style. (Mapped NOS: PCS/ N9452)	22. Function of keys and practice of basic commands. (20 hrs) 23. Use of elementary commands by CAD toolbar. (14 hrs) 24. Creation of objects in different layers on CAD workspace. (14 hrs) 25. Plotting of drawing from CAD. (14 hrs) 26. 2D drafting of flash door, panel panel door, window, hand railing, wash basin, sewerage pipe joints, etc. (20 hrs) 27. Preparing Library folder by creating blocks of the above items. (12 hrs) 28. Study and prepare bar bending schedule(20 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. (04 hrs)

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Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With indicative hour)	Professional Knowledge (Trade Theory)
Professional Skill 28 Hrs; Professional Knowledge 04 Hrs	Identify different types of building materials i.e. Stones, Bricks, Lime, Pozzolanic, Cement, Sand, Clay Products, Mortar their characteristic, types, use & function. (Mapped NOS: PCS/ N9453)	29. Identify different types of bricks, uses and hollow bricks. Standard size of bricks available at local market. (04 hrs) 30. Identify different types of stones, types and uses. (04 hrs) 31. Identify different types of tiles, types and uses. (03 hrs) 32. Identify different types of cement, types and uses, field test of cement. Etc. (03 hrs) 33. Identify different types of sand and aggregates, types and uses. (03 hrs) 34. Identify different types of lime, types and uses. (03 hrs) 35. Identify different types of steel, types and uses. (04 hrs) 36. Identify different types of timber, earthen ware, types and uses. (04 hrs)	Materials:- • Stones :– characteristics, types & uses. • Bricks :– Manufacturing, characteristics of good bricks, types,uses and hollow bricks. • Lime :– characteristics, types, manufacturing & its uses. • Pozzolanic :- characteristics, types & uses. Cement :– Manufacturing, characteristics, types, uses and test of good cement. Building materials:- • Sand:- characteristics, types & uses. • Clay Products :– types, earthenware, stoneware, porcelain, terracotta, glazing. Mortar & Concrete: Types, uses, preparation, proportion, admixtures and applications. (04 hrs)
Professional Skill 28 Hrs; Professional Knowledge 10 Hrs	Mark different types of Foundation and Set out Foundation trenches. (Mapped NOS: PCS/N9454)	37. Setting out a building: Obtaining first, second, third & fourth lines, marking diagonals, setting out cross walls & offsets. (13 hrs) 38. Marking excavation lines & fixing of plinth & floor levels. (05 hrs) 39. Set out foundation trench. (10 hrs)	Building Construction:- Foundation:- • Purpose of foundation • Causes of failure of foundation • Bearing capacity of soils • Dead and live loads • Examination of ground • Types of foundation – (Spread Footing, Grillage foundation, Pile foundation, Raft foundation, Well foundation, Special foundation) • Drawing of footing foundation setting out of building on ground excavation • Simple machine foundation. (10 hrs)
Professional Skill 12Hrs; Professional Knowledge 06 Hrs	Demonstrate different types of brick masonry and Tools used in different bonds. Perform construction of wall - header bond, stretcher bond, English bond, Flemish bond. (Mapped NOS: PCS/N9455)	40. Demonstrate the use of brick masonry tools. (02 hrs) 41. Perform construction of wall header bond, stretcher bond, English bond, Flemish bond (10hrs)	Building Construction:- • Sequence of construction of a building. • Name of different parts of building. • Brick masonry:- • Terms, use and classification.. • Strength of walls. • Strength of masonry. • principles of construction of bonds. Tools and equipments used.(06 hrs)

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Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With indicative hour)	Professional Knowledge (Trade Theory)
Professional Skill 24 Hrs; Professional Knowledge 06 Hrs	Perform different types of Plastering & Pointing, rendering & wall cladding. (Mapped NOS: PCS/N9456)	42. Make scaffolding and prepare surface for plastering. (04 hrs) 43. Perform plastering operation at different surface - Plaster in two coats -External finishes— sand finish, textured finish. (14 hrs) 44. Perform rendering & wall cladding. (06 hrs)	Plastering : Types, thickness in different position, materials, tools used, defects and remedies, surface preparation for rendering & wall cladding. Special meterials used in plastering. Types of plaster finishes.(06 hrs)
Professional Skill 24 Hrs; Professional Knowledge 06 Hrs	Identify different types of Protective materials i.e. Paint, Varnish and their application. (Mapped NOS: PCS/N9457)	45. Perform application of cement paint on different surfaces (07hrs) 46. Perform application of plastic emulsion on different surfaces (06 hrs) 47. Perform application of enamel paint on different surfaces(05 hrs) 48. Perform application Process of varnishing on different surfaces (06 hrs)	Protective materials:- • Paints:- characteristic, types, uses. • Varnishes :– characteristics and uses.(06 hrs)
Professional Skill 20 Hrs; Professional Knowledge 06 Hrs	Demonstrate Damp Proof Course in different position. (Mapped NOS: PCS/N9458)	49. Perform Laying of D.P.C with proper methods and Materials. (20 hrs)	Treatments of building structures:- • DPC Sources and effects of dampness • Method of prevention of dampness in building • Damp proofing materials – properties, function and types. (06 hrs)
Professional Skill 28 Hrs; Professional Knowledge 06 Hrs	Prepare different types of Flooring (Mapped NOS: PCS/N9459)	**Flooring practice:** 50. Determination and Formation of slope / level, laying of Base Layers, laying of Topping,application of slurry for finishing, setting out of skirting, formation of spots for skirting. (18 hrs) 51. Use of screeds, formation of curve at the junction of skirting & floor. (10 hrs)	• Floors –Types of flooring. • Flooring- materials used types. prepare method of laying, grinding & polishing of floor and prepare a survey report on materials used in flooring, site visit to check the practical techniques of flooring.(06 hrs)
Professional Skill 35 Hrs; Professional Knowledge 06 Hrs	Perform site survey with Chain/Tape and prepare the site Plan. (Mapped NOS: PCS/N9460)	52. Practice of folding & unfolding of chain. (4 hrs) 53. Ranging (direct/ indirect) & distance measure with chain/ tape. (7 hrs) 54. Offset taking & entering field book. (4 hrs) 55. Chaining on sloping ground. (6 hrs) 56. Conduct a chain survey of a small area with all details and plotting the map. (9 hrs) 57. Calculating the area of site. (3 hrs) 58. Prepare a site plan by the help of chain / tape. (5 hrs)	linear & Angular measurement by instrument i.e. Chain, tape, compass etc. • Introduction, , types of surveying, use, application principle. • Main divisions (plane & geodetic). Uses of Chain/ tape, testing of a chain & correction. Ranging (direct & indirect), Principle of chain survey, application. Terms used in chain survey, types of offsets, limit of offset, field book, types of field book, entry of field book,

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Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With indicative hour)	Professional Knowledge (Trade Theory)
			method of chaining in slopping ground. Field procedure of chain survey errors in chain survey, plotting procedure. Calculation of area (regular & irregular figure) • Knowledge of site plan. • Knowledge of Mouza Map. (06 hrs)
Professional Skill 15 Hrs; Professional Knowledge 06 Hrs	Perform the site survey using Prismatic Compass. (Mapped NOS: PCS/N9461)	59. Temporary adjustment of prismatic compass. (03 hrs) 60. Measure fore & back bearing, R.B.,W.C.B. of a line. (02hrs)] 61. Measure true bearing of a line. (02hrs) 62. Prepare a closed & open traverse using prismatic compass measure the bearings, entry into field book, calculation of correct bearing and adjust. (Local attraction), determine the closing error and adjust. Plotting the same. (08 hrs)	**Surveying:-** **Compass survey:-** • Basic terms used in compass survey. • Instrument &its setting up. • Conversion of bearing web to R.B. • Calculation of included angle from bearing local attraction, magnetic declination and true bearing, closing error. • Adjustment of closing error, precaution in using prismatic compass. (06 hrs)
Professional Skill 14 Hrs; Professional Knowledge 06 Hrs	Perform site survey with Plane Table and prepare a map. (Mapped NOS: PCS/N9462)	63. Demonstration of instrument used for plane table surveying & their uses (alidade, U-fork, trough compass) Set up the plane table. (03 hrs) • Centering • Levelling • Orientation 64. Practice the method of plane tabling (07 hrs) • Radiation • Intersection • Resection • Traversing 65. Determination of height by telescopic alidade. (04 hrs)	**Plane table survey:-** • Plane table survey, principle, merits & demerits • Instrument used in plane table survey setting up the plane table. (centering, levelling, orientation) • Methods of plane table survey (radiation, intersection, resection, traversing) • Error in plane table survey. (06 hrs)
Professional Skill 53 Hrs; Professional Knowledge 06 Hrs	Prepare topography map by contours with levelling instruments. (Mapped NOS: PCS/N9463)	**Levelling:- (53 hrs)** 66. Handling of levelling instruments & their settings.(3) 67. Temporary adjustment of a level (3). 68. Simple levelling..(3) 69. Differential levelling (Fly levelling).. (3) 70. Carry out Levelling field book..(3) 71. Equate Reduction of levels Height of collimation and Rise and Fall method – Comparison of methods..(3) 72. Solve problems on reduction of levels .(3).	Levelling:- • Auto level , dumpy Level, Tilting Level - introduction, definition • Principle of levelling. • Levelling staffs, its graduation & types. • Minimum equipment required • Types, component / part and function. • Temporary and permanent adjustment, procedure in setting up.

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Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With indicative hour)	Professional Knowledge (Trade Theory)
		73. Calculate Missing data and fill up calculations & Arithmetical check in various problems and its solution..(4) 74. Practice levelling with different instruments. .(3) 75. Check levelling..(4) 76. Profile levelling or Longitudinal , plotting the profile. .(4) 77. Surveying of a building site with chain and Levelling Instrument with a view to computing earth work..(4) 78. Contour - Direct and Indirect methods..(3) 79. Make Topography map, contours map..(3) 80. Solve trigonometric problems..(3) 81. Prepare a road project in a certain alignment..(4)	• Level& horizontal surface. Datum Benchmark, Focussing & parallax • Deduction of levels / Reduced Level. • Types of levelling, Application to chain and Levelling Instrument to Building construction. • Contouring ;-Definition, Characteristics, Methods. • Direct and Indirect methods • Interpolation of Contour, Contour gradient , Uses of Contour plan and Map. • Knowledge on road project. (06 hrs)
Professional Skill 12 Hrs; Professional Knowledge 06 Hrs	Perform a site survey with Theodolite and prepare site plan. (Mapped NOS: PCS/ N9464)	**Theodolite survey:- (12hrs)** 82. Field work of theodolite..(1) 83. Measure Horizontal angle. Vertical angle, magnetic bearing of a line..(2) 84. Levelling with a theodolite..(2) 85. Calculation of area from traverse..(2) 86. Determination of Heights..(2) 87. Calculation of departure, latitude, northing and easting. (2) 88. Setting out work-Building work, etc. (1)	• Introduction and Types of Theodolite, • parts of Theodolite, • Terms used in Theodolite survey. • Temporary adjustment of Theodolite, • Angle measurement process. Reading of angles, field book entry of measured angles. • Permanent adjustment of Theodolite.(06 hrs)
Professional Skill 14 Hrs; Professional Knowledge 06 Hrs	Perform a site survey with Total Station and prepare site plan. (Mapped NOS: PCS/ N9465)	89. Application of survey using Total Station. (1 hrs) 90. Field procedure for coordinate measurement. (1 hrs) 91. Field procedure to run open traverse and closed traverse. (2 hrs) 92. Transfer or establish Bench Mark. (1 hrs) 93. Perform stakeout / demarcation of building layout /plot layout/ roads/ alignment. (1 hrs) 94. Measure remote distance and elevation. (1 hrs) 95. Calculate surface area on field/site. (1 hrs) 96. Calculate volume of field/site. (1 hrs) 97. Procedure for down load and up load data. (1 hrs) 98. Simple survey map using Auto CAD. (4 hrs)	**Total Station:-** • Introduction. • components parts, accessories used. • characteristics, features. • advantages and disadvantages. • principle of EMD. • Working and need. • Setting and measurement. • Electronic, display & Data reading. • Rectangular and polar coordinate system. • Terminology of open and closed traverse. (06 hrs)

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Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With indicative hour)	Professional Knowledge (Trade Theory)
Professional Skill 26 Hrs; Professional Knowledge 06 Hrs	Identify timber and perform sawing and planning using hand and power tools. (Mapped NOS: MIN/ N0454)	99.Identify different wooden sample piece i.e.- soft wood & hard wood, wooden grains etc. & their applications Annual ring, knots, shakes &chicks etc.). (03hrs) 100.Demonstrate application of hand tools, measuring tools, and work holding devices. (03 hrs) 101.Demonstrate use of different power tools, viz. saws, drills, etc. (03hrs) 102.Perform sawing, planning, Moulding, Rebating, Chamfering, etc. using different types of saws, and plains. (14 hrs) 103.Sharpen and set different type saw blade and planner blade/ cutter. (03hrs)	• Common Indian timbers • Defects in timber, diseases of timber, knots, shakes, grains etc. • carpentry hand tools, measuring tools and uses. • work holding devices, power tools, viz. saws, drills, etc. • Description of Carpentry Joinery, Planing, Moulding, Rebating, Chamfering, Sawing, etc.(06 hrs)
Professional Skill 20 Hrs; Professional Knowledge 06 Hrs	Demonstrate surface finish with exact sizing by planning operation. (Mapped NOS: MIN/ N0454)	104.Planning face, face edge, etc. (5hrs) 105.Demonstrate the use of marking, mortise gauge etc. (3 hrs) 106. Test the accuracy of flatness and twist-ness of the surface by using try square. (4 hrs) 107. Demonstrate the use of winding strips, cross planning, edge planning. (4hrs) 108. Demonstrate portable power planer machine and its function. (4 hrs)	• Type of different planes and their proper uses in wood work - Description, function and its size, setting, knowledge of sharpening and uses etc. • knowledge of using marking gauges. • Important instruments necessary for checking flatness and twistness of surface • Sharpening and grinding angle of cutter. • Portable power planner - useful in modern wood work and new technology design. (06 hrs)
Professional Skill 28 Hrs; Professional Knowledge 08 Hrs	Prepare different wooden Joints. (Range of skill - framing joint, Housing joints, broadening joints, Lengthening joints). (Mapped NOS: MIN/ N0454)	Prepare different wooden joints by using different tools - 109. **Make framing joint** - Mortise and tenon Joint (Single and double, Plain hunched, Mitre corner) (08hrs) 110. **Make Housing joints** - Full housing, Bridle, Stopped housing (04 hrs) 111. **Make broadening joints** - Simple butt joint, Riveted butt joint, etc. (08 hrs) 112. **Lengthening joints**: End half lap joint, End over lap joint, End bends lap joint, slopping scarf, racking scared, half lapping scarf , table scarf joint etc. (08 hrs)	• Description of different types joint. • Uses of joint :- Framing joint angle joint and lengthening joint, housing joint, broadening joint etc. • Wood products - Industrial forms of timber - Veneer - Laminated sheet - Fibre board - Hard board - Plywood(08 hrs)

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Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With indicative hour)	Professional Knowledge (Trade Theory)
Professional Skill 20 Hrs; Professional Knowledge 06 Hrs	Make small wooden job as per drawing with schedule sizes of timber or alternatives of timber i.e. FRP, MDF, FOAM using various hardware. (Mapped NOS: PCS/N9466)	**Make small wall bracket** 113. Make joint on hard wood to make small frame. (7 hrs) 114. Stopped Tenon & Mortise joint on hard wood in the frame to set the shelves. (6 hrs) 115. Make selves by six pieces of hard wood with single lapped half lap dovetail joint with frame (two nos. of shelves). (07hrs)	• Calculation of timber required for Wall Bracket • List out the sequence of operation of the job (06 hrs)
Professional Skill 28 Hrs; Professional Knowledge 06 Hrs	Make different types of doors and windows with fixing of component. (Mapped NOS: PCS/N9467)	Making of :- 116. Different Types doors including panelled, glazed and flush door. (20 hrs) 117. Different types windows and ventilators. (08 hrs)	• Doors –Parts, Location, standard sizes, types. • Windows-types. Ventilators-purpose-types. (06 hrs)
Professional Skill 28 Hrs; Professional Knowledge 04 Hrs	Demonstrate joining of electrical wire and carry out soldering, crimping observing related safety precautions. (Mapped NOS: MIN/N3102)	118. Prepare terminations of cable ends (02 hrs) 119. Practice on skinning, twisting and crimping. (04 Hrs) 120. Identify various types of cables and measure conductor size using SWG and micrometer. (02 Hrs) 121. Make simple twist, married, Tee and western union joints. (08 Hrs) 122. Make britannia straight, britannia Tee and rat tail joints. (08 Hrs) 123. Practice in Soldering of joints / lugs. (04 Hrs)	Electrical Wiring:- • Safety precaution and elementary first aid. • Artificial respiration and treatment for electrical shock • Elementary electricity and its units. • General ideas of supply system. • Wireman's tools kit. Wiring materials. Electrical fittings. • System of wirings. Wiring installation for domestic lightings. • Conductor, insulator, semi-conductor, cable joints, measurement of cable (04 hrs)
Professional Skill 28 Hrs; Professional Knowledge 06 Hrs	Demonstrate Electrical wiring with fixing of accessories conforming ISI rules (Range of skills - different types of Electrical wiring, joining of Fuses, fixing of MCB, connection of lamp with switch and different fitting, etc.). (Mapped NOS: MIN/N3102)	124. Demonstrate different electrical wiring system with fixing of different accessories. (03 hrs) 125. Make electrical Fuse joints, fixing MCB. (3 hrs) 126. Connect lamps with switches. (06 hrs) 127. Stair case circuit wiring. (4 hrs) 128. Godown wiring. (6 hrs) 129. Hospital wiring. (6 hrs).	• Types of Fuses, MCB soldering, ELCB, RCCB, ABCB, MCCB AC and DC, AC fundamentals, poly phase • types of electrical wiring • Different Electrical wiring accessories, • ISI rules of wiring • Illumination (06 hrs)
Professional Skill 28 Hrs; Professional Knowledge 04 Hrs	Demonstrate installation of electrical appliances, Earthing and estimate costing of wiring. (Mapped NOS: MIN/N3102, MIN/N3104, MIN/N3102)	130. Install earthing in different position. (10 hrs) 131. Install and connect electrical appliances and take reading with Voltmeter. (10 hrs) 132. Prepare materials list and costing of wiring. (04 hrs)	• Earthing, types of earthing Earthing Pit. • Different electrical appliance, accessories, Voltmeter. • Estimation and costing of wiring.(02 hrs)

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Duration	Reference Learning Outcome	Professional Skill (Trade Practical) (With indicative hour)	Professional Knowledge (Trade Theory)
	Identify different type of transformers and test and use. (Mapped NOS: MIN/N3101, MIN/N3102, MIN/N3103)	133. Identify transformer, test and use. (04 hrs)	Explanation and working of different type of transformers and its classification. (02 hrs)
Professional Skill 18 Hrs; Professional Knowledge 10Hrs	Prepare a Simple pipe connection demonstrating cutting, joining of pipe with different method using different types of fittings. (Mapped NOS: MIN/N3208)	134. Perform Simple pipe connection using G.I. Pipes, socket, elbow, tee, reducing elbow, G.I. union, cap plug, reducer, Three face elbow, reducing socket, plug, G.I. nipple etc. (18 hrs)	Plumbing tools, materials used in plumbing. (02 hrs) Different types of pipes, fittings and Joints - GI, PVC, AC,SW, CI, lead, steel - Properties and use in plumbing work (04 hrs) Method of cutting and joining of pipes. Drills - types and uses. Tap and Dies - types and uses, calculation of Tap drill size.(04 hrs)
Professional Skill 33 Hrs; Professional Knowledge 12 Hrs	Prepare layout of soil pipe and waste pipe with different types of sanitary fittings. (Mapped NOS: PCS/N9468)	135. Layout of soil pipe and waste pipe to the sanitary fitting using different types of fitting viz. Door junction, door Bend , H.R. bend, Plain Bend, Double door junction, inverter junction, cowel , floor trap, Gully trap, P-trap etc. (7 hrs) 136. Fitting of I.W.C with high level cistern. (06 hrs) 137. Fitting of washbasin (04 hrs) 138. Fitting of E.W.C. with low level cistern. (04 hrs) 139. Fitting of kitchen sink. (04 hrs) 140. Fitting of bath tub. (04 hrs) 141. Fitting of urinal pot with auto cistern. (04 hrs)	Sanitary Technical terms - sewer, sewage, sullage etc. -Soil pipe and waste pipe fitting Different types of water closets Different types of urinal port Kitchen sinks, Bath tub, Wash basin. (12 hrs)
Professional Skill 28 Hrs; Professional Knowledge 14 Hrs	Prepare a water supply system in residential buildings using different types of valves, fittings and appliances. (Mapped NOS: PCS/N9469)	142. Install water meter. (04 hrs) 143. Remove air lock. (03 hrs) 144. Determination of pH by pH meter. Analysis and treatment of Effluent water. (05 hrs) 145. Recondition taps, valves & flushing tank, test for correct functioning. (03 hrs) 146. Prepare a water supply pipe line system in residential buildings using different types of valves, fittings and appliances. (05 hrs)	Water meter • Installation of water meter • Removal of air lock Purification of water • Mineral matter, Hardness, Causes of Scale formation & their Removal. Water Purification: Treatment plants for different groundwater contaminants, Treatment plants for surface water. (07 hrs) Types of damages in taps, valve, water meter and tanks - Method of rectification Water supply - Sources of water Storage of water Distribution of water Different types of valves used in Plumbing, Types of tanks R.C.C., P.V.C. Iron tanks etc. (07 hrs)
	Create objects on 3D Modelling concept in CAD (Mapped NOS: PCS/N9470)	147. Prepare different objects on 3D Modelling concept in CAD. (08 hrs)	

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Importance of trade training and demonstrate tools, equipments and uses

Objectives: At the end of this exercise you shall be able to
- **follow the importance of trade training**
- **execute tools and equipment used in the trade**
- **identify the name of the tools and equipments shown in fig**
- **identify the purpose of the each tools and equipments and fill in the table.**

PROCEDURE

TASK 1 :**Importance of Civil Engineering Assistant Trade**

- Prepare hand sketches of hand tools.
- Safety, first aid, house keeping, occupational safety, use of fire extinguishers.
- Lettering, numbering, dimensioning technique.
- Plain scale. comparative scale, diagonal scale, vernier scale.
- Orthographic projection, Isometric, perspective
- Parts of single storied building
- CAD - Using tool bars, commands, menus, formatting, layer, style.
- Building materials, brick and stone masonry.
- Chain, prismatic compass, plane table, levelling. theodolite, total station, survey and plotting
- Carpentry joints - Use of hand and power tools.
- Doors, windows, electrical wiring.
- Pipe fitting, sanitary fittings - water supply.
- Computer practice - 3D modelling in CAD
- Prepare R.C.C - scaffolding
- Stairs, lift, ramp, escalator, pile foundation.
- Residential building, plan using CAD - Architectural
- Detailed estimate
- Plastering, painting, white washing
- House plumbing, construction equipment
- Construction management

The syllabus of the trade is available in DGT website and you can download for further details.

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TASK 2: **Identify the name of the tools and equipments (Fig 1 - 27)**

Instructor should demonstrate each tools name and their purposes as shown in figure.

Fig 1



TROWEL

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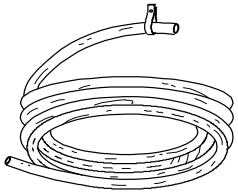
Fig 2



MORTAR PAN

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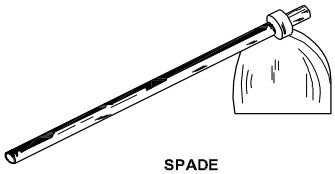
Fig 3



CURING PIPE

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Fig 4



SPADE

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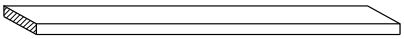
Fig 5



COMPACTING ROD

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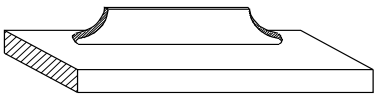
Fig 6



STRAIGHT-EDGE

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Fig 9



WOODEN FLOAT

CE20N1101H9

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Fig 7

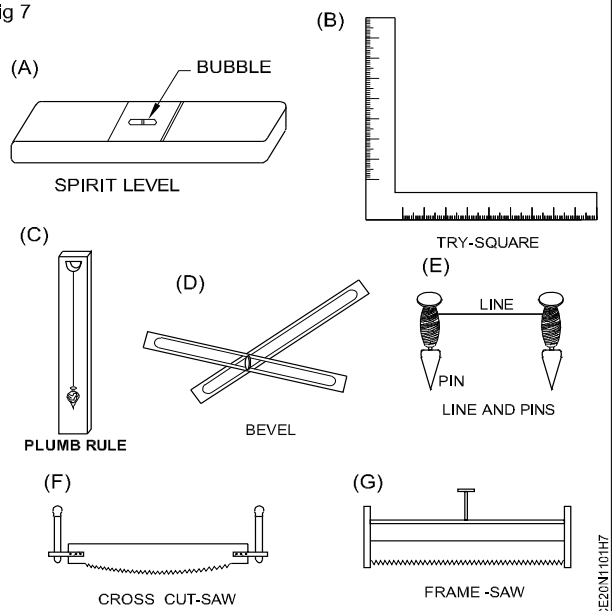
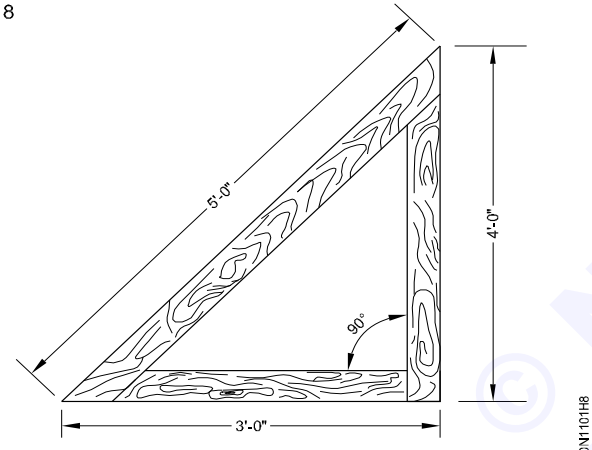
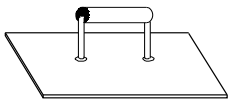


Fig 8



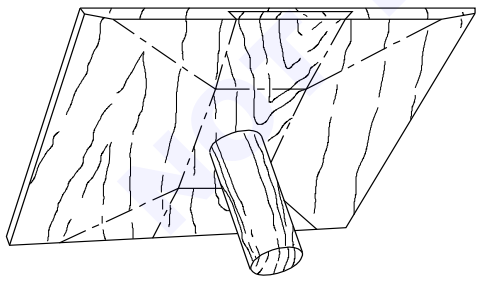
LARGE SQUARE OR MASON'S SQUARE

Fig 10



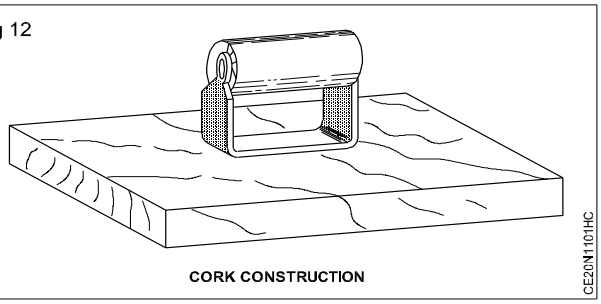
METAL FLOAT

Fig 11



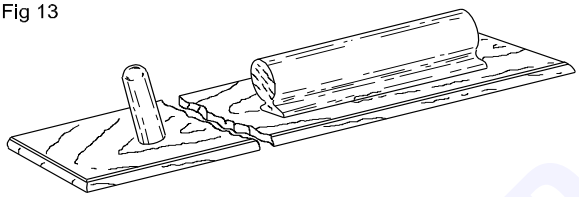
WOOD HAWK USED TO CARRY THE PLASTER MATERIAL TO THE WALL OR CEILING

Fig 12



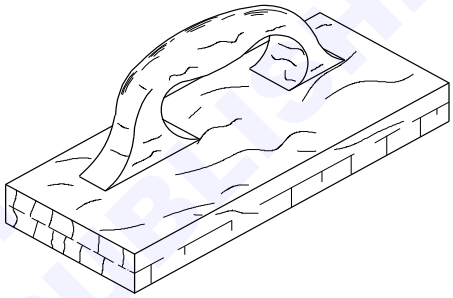
CORK CONSTRUCTION

Fig 13



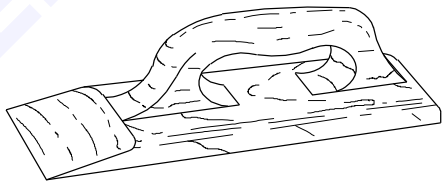
AN ORDINARY WOODEN DARBY USED TO LEVEL LARGE AREAS OF PLASTER

Fig 14



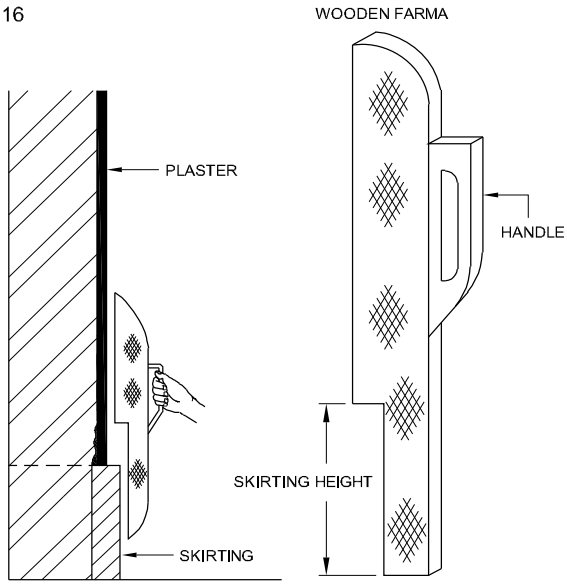
CORK-FACED FLOAT WITH HARD WOOD BACKING

Fig 15



WOOD ANGLE

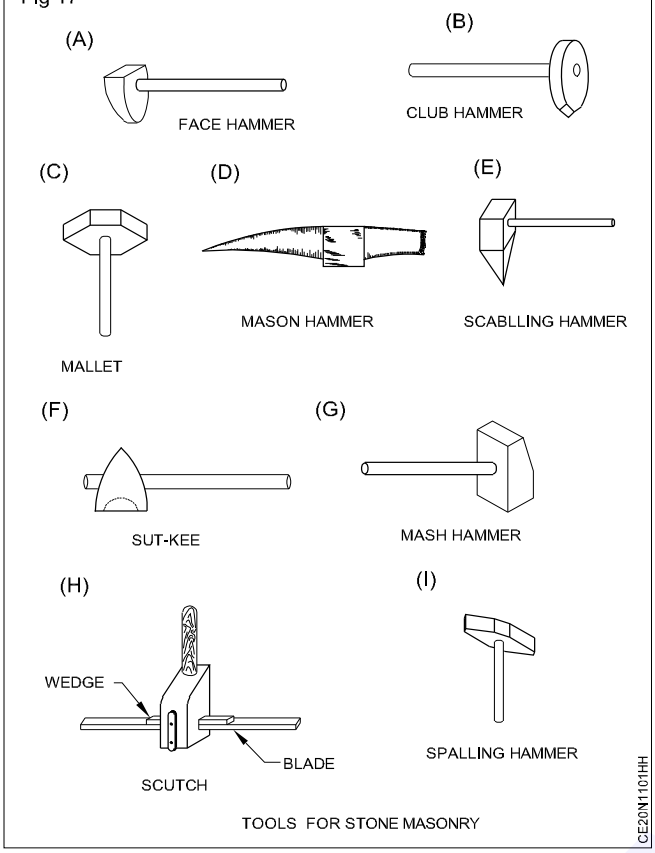
Fig 16



WOODEN FORMA (TEMPLATE) FOR SKIRTING

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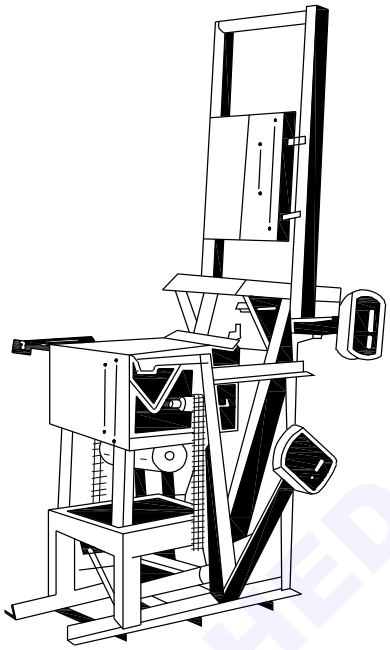
Fig 17



TOOLS FOR STONE MASONRY

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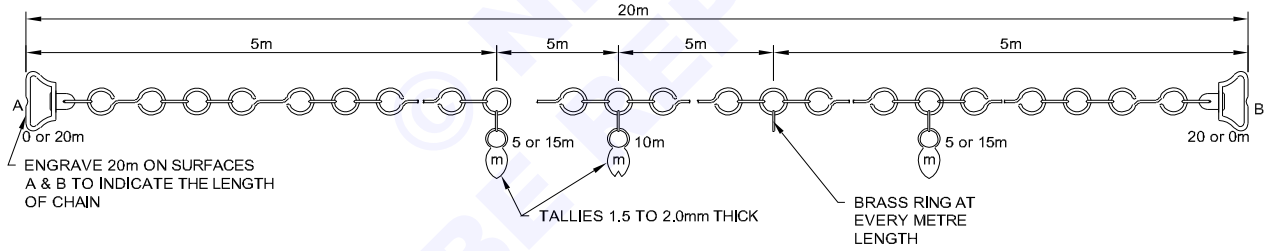
Fig 18



HAND OPERATED BLOCK MACHINE

CE20N1101HI

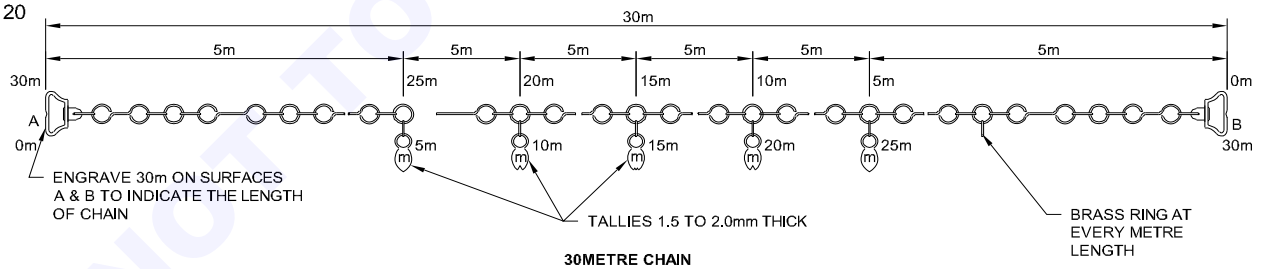
Fig 19



20 METRE CHAIN

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Fig 20

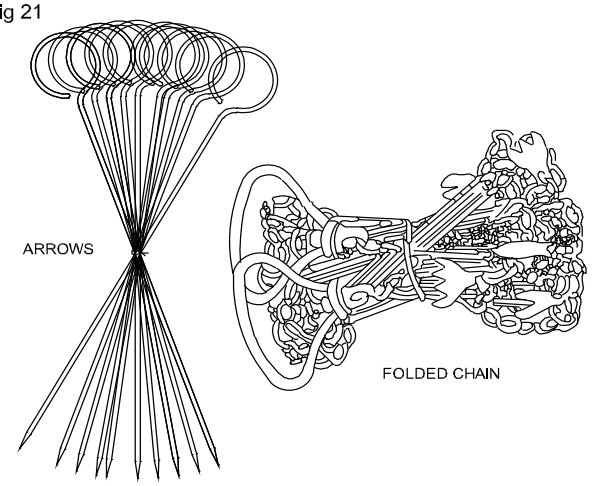


30METRE CHAIN

CE20N1101HK

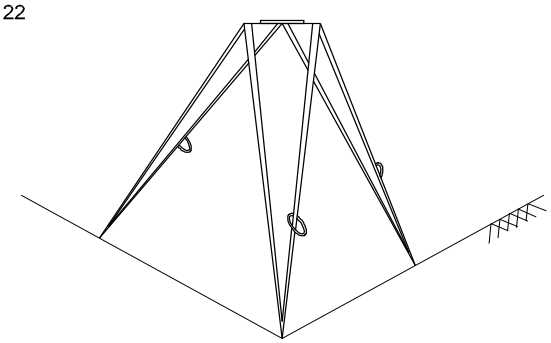
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Fig 21



CE20N1101HL

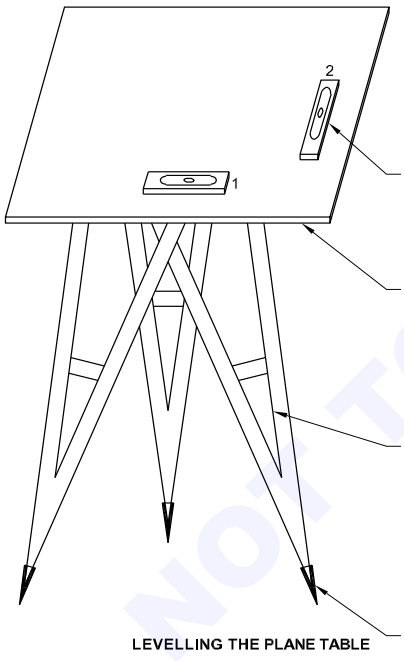
Fig 22



TRIPOD STAND

CE20N1101HM

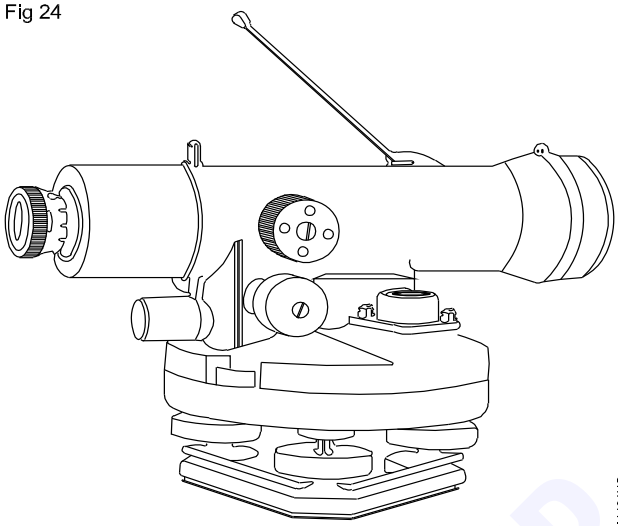
Fig 23



LEVELLING THE PLANE TABLE

CE20N1101HM

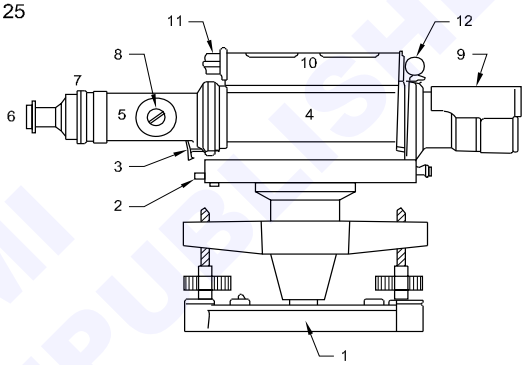
Fig 24



DUMPY LEVEL

CE20N1101HO

Fig 25

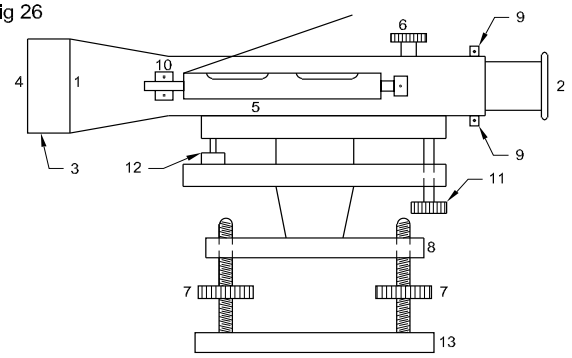


1. LEVELLING HEAD
2. LIMB NUTS
3. STOP-SCREWS
4. SOCKET
5. TELESCOPE
6. EYE-PIECE
7. DIAPHRAM SCREWS
8. FOCUSSING SCREW
9. RAY-SHADE
10. LEVEL TUBE
11. LEVEL TUBE NUTS
12. CROSS-BUBBLE TUBE

COOKE'S REVERSIBLE LEVEL

CE20N1101HP

Fig 26



1 TELESCOPE
2 EYE-PIECE
3 RAY SHADE
4 OBJECTIVE END
5 LEVEL TUBE
6 FOCUSING SCREWS
7 FOOT SCREWS
8 TRIBACH
9 DIAPHRAGM ADJUSTING SCREWS
10 BUBBLE TUBE FIXING SCREWS
11 TILTING SCREWS
12 SPRING LOADED PLUNGER
13 TRIVET STAGE

TILTING LEVEL

CE20N1101HQ

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Fig 27

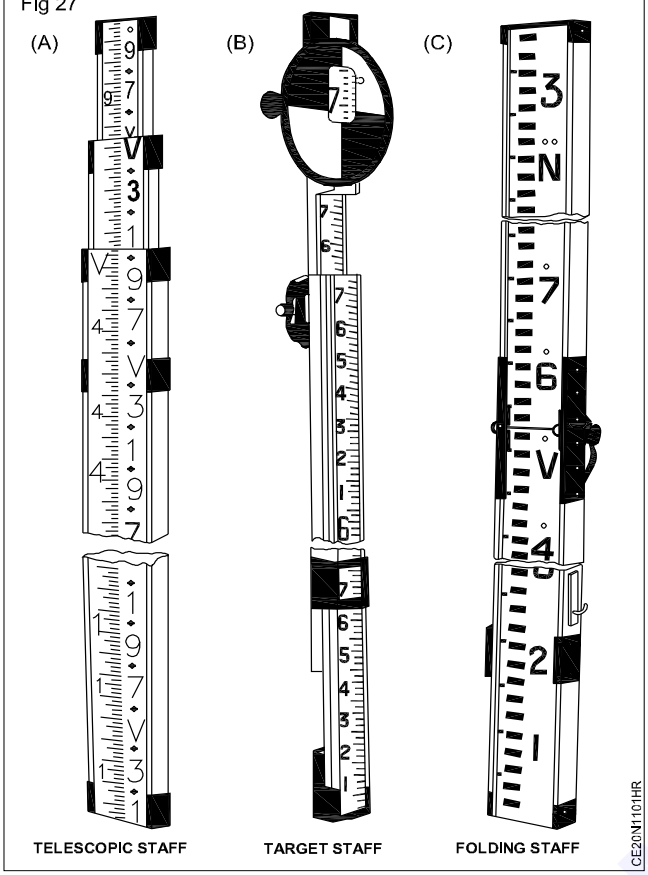
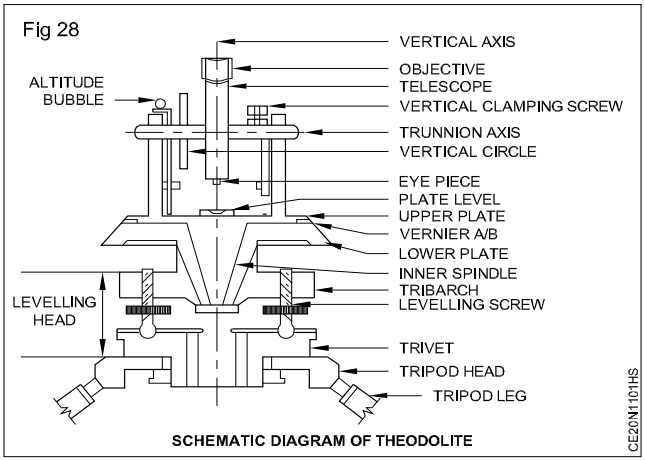


Fig 28



- Trainees should identify the name of the tools and their purposes demonstrated by the instructor.
- The trainees are asked to fill the name of tools and their purposes in the table -1.

Table 1

Sl. No	Name of the tools and equipment	Uses / Purposes
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

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Sl. No	Name of the tools and equipment	Uses / Purposes
21		
22		
23		
24		
25		
26		
27		

— — — — — — — —

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Importance of housekeeping and good shop floor practice

Objectives: At the end of this exercise you shall be able to
- **follow the activities to be performed for better up keeping of working environment**
- **follow good shop floor practices.**

PROCEDURE

TASK 1: **Follow the activities to be performed for better upkeeping of working environment**

Housekeeping

The following activities to be performed for better up keep of working environment.

1 **Cleaning of shop floor:** Keep the shop floor clean and free from accumulation of dirt for daily use.

2 **Cleaning of Machines:** Keep the machines cleaned well in order to reduce accidents.

3 **Prevention of Leakage and spillage:** Use splash guards in machines and collecting tray.

4 **Disposal of scrap:** Empty scrap, wastage, swarf from respective containers regularly.

5 **Tool storage:** Use special racks, holders for respective tools.

6 **Storage spaces:** Identify storage areas for respective items. Do not park material in aisle.

7 **Piling Methods:** Do not overload platform, floor and keep material at safe height.

8 **Material handling:** Use forklifts, conveyors and hoist.

Good shop floor practices

- Good shop floor practices are motivating action plans for the improvement of the manufacturing process.
- All workers are communicated with daily target on manufacturing activities.
- Informative charts are used to post production, quality and safety results compared to achievements.
- Workers are trained on written product quality standards.
- Manufactured parts are inspected to ensure adherence to quality standards.
- Production processes are planned by engineering to minimize product variation.
- 5S Methods are used to organize the shop floor and production lines.
- Workers are trained on plant safety practices in accordance with OSH standards.
- Workers are trained on "root cause" analysis for determining the causes of non-conformances.
- A written preventive maintenance plan for the upkeep of plant machinery & equipment.
- Management meets with plant employees regularly to get input on process improvements.
- Process improvement teams are employed to implement "best practices".

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Occupational safety and Health

Objectives: At the end of this exercise you shall be able to
- **suggest safety measure for the accidents.**

Instructor shall explain the accidents to the trainees. Ask the trainees to write the remedy in table 1.

PROCEDURE

- Suggest the remedy for each accidents
- Record the remedies on each column in table 1

Table 1

Sl.No.	Accidents	Remedy
1		
2		
3		
4		
5		
6		

Get it checked by instructor

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Introduction to safety equipments and their uses

Objectives: At the end of this exercise you shall be able to
- **identify personal protective equipments**
- **write the names and uses in table 1.**

Fig 1



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- Read and interpret the visuals of personal protective equipment on real devices or from the charts.
- Identify and select personal protective equipment used for different types of protection.
- Write the name of the PPE and the use in table 1.

The instructor shall display the different types of personal protective equipment or charts and explain how to identify and select the PPE devices suitable for the work and ask the trainees to note down the name and use in Table 1.

The instructor shall demonstrate how to wear and remove all the PPE's.

Ask the trainees to practice it.

Table 1

S.No.	Name of the PPE	Uses
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Get it checked by your instructor.

Introduction to First aid & health

Objectives: At the end of this exercise, you shall be able to
- **provide first aid for chocking, wound, burn, bites and sting on human.**
- **take care of a person with eye injury, nose bleeding, diabetes, heat exhaustion by first aid treatment**
- **give first aid treatment to person with heat stroke.**

PROCEDURE

TASK 1: **Chocking**

1 Severe choking: back blows and abdominal thrusts as shown in Fig 1.

2 Stand behind them and slightly to one side. Support their chest with 1 hand. ...

3 Give up to 5 sharp blows between their shoulder blades with the heel of your hand. ...

4 Check if the blockage has been cleared.

5 If not, give up to 5 abdominal thrusts.

Fig 1



CHOCKING

CE20N1103J1

TASK 2: **Wound (Fig 1 & 2)**

The first step in care of a wound is to stop the bleeding.

1 Locate the source of the bleeding.

2 Wash your hands and, if possible, wear gloves or use a barrier between you and the wound.

3 Remove any loose debris.

4 Apply direct pressure on wound (Fig 1)

5 Dress the wound with cotton bandage (Fig 2)

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Fig 1



Fig 2



TASK 3: **Burns (Fig 1 - 3)**

Fig 1



Fig 2



Fig 3



Treating minor burns

1 Cool the burn.

2 Remove rings or other tight items from the burned area.

3 Don't break blisters.

4 Apply lotion.

5 Bandage the burn.

6 If needed, take a nonprescription pain reliever, such as ibuprofen (Advil, Motrin IB, others), naproxen sodium (Aleve) or acetaminophen (Tylenol, others).

TASK 4: **Bites and Stings (Fig 1 - 3)**

Fig 1

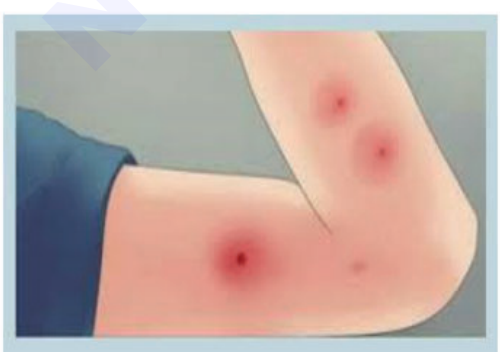


Fig 2



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1 Stop the wound from bleeding by applying direct pressure with a clean, dry cloth.

2 Wash the wound.

3 Apply an antibacterial ointment to the wound.

4 Put on a dry, sterile bandage.

5 If the bite is on the neck, head, face, hand, fingers, or feet, call the Doctor right away

Fig 3



TASK 5: **Eye Injury (Fig 1 & 2)**

Fig 1



Fig 2



1 Ask patient to look up.

2 Draw lower eyelid down. If object visible, remove with corner of moist cloth.

3 If not visible, pull upper lid down.

4 If unsuccessful, wash eye with sterile saline or clean water.

5 If still unsuccessful, cover injured eye only and seek medical aid.

TASK 6: **Nose Bleedings (Fig 1 & 2)**

1 Make the patient to sit straight and bend forward the head portion only (This will reduce blood pressure in the Veins of his nose)

2 Ask the patient to breathe out from the nose.

3 Pinch the nose to take out the blood in the nose.

4 To prevent re-bleeding, don't pick or blow his nose and don't allow him to bend down for several hours.

5 If re-bleeding occurs, go through these steps again.

Fig 1



NOSE BLEED

CE20N1103O1

Fig 2



CE20N1103O2

TASK 7: **Diabetes (Low blood Sugar) (Fig 1 & 2)**

1 Follow the Basic First Aid Plan to assess the casualty.

2 Give high-energy foods or sugar.

3 Only give food if the casualty is conscious.

4 If medical aid is delayed give sugar every 15 minutes.

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Fig 1



Fig 2



5 The casualty will recover quickly if low blood sugar level is the cause.

— — — — — — — —

TASK 8: **Heat Exhaustion (Fig 1 & 2)**

Fig 1



Fig 2



Heat Exhaustion

1 Rest in a cool place. Getting into an air-conditioned building is best, but at the very least, find a shady spot or sit in front of a fan.

2 Drink cool fluids. Stick to water or sports drinks.

3 Try cooling measures.

4 Loosen clothing.

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TASK 9: **Heat Stroke**

1 Put the person in a cool tub of water or a cool shower.

2 Spray the person with a garden hose.

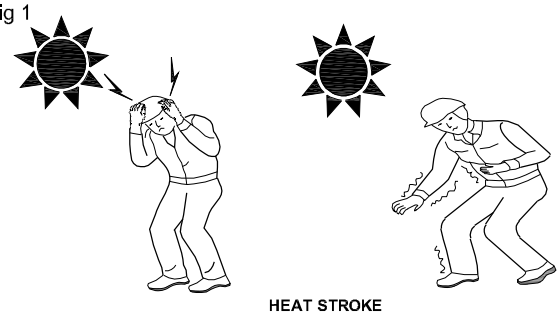
3 Sponge the person with cool water.

4 Fan the person while misting with cool water.

5 Place ice packs or cool wet towels on the neck and armpits.

6 Cover the person with cool damp sheets.

Fig 1



— — — — — — — —

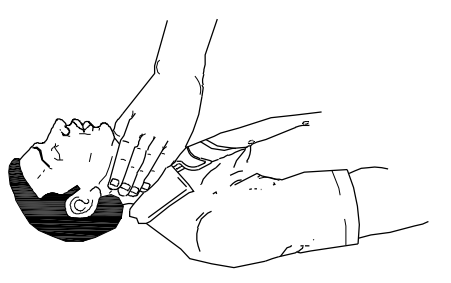
TASK 10: **Resuscitate a victim who is under cardiac arrest by (CPR) cardio pulmonary resuscitation**

In cases where the heart has stopped beating, you must act immediately.

1 Check quickly whether the victim is under cardiac arrest.

Cardiac arrest could be ascertained by the absence of the cardiac pulse in the neck (Fig 1), blue colour around lips and widely dilated pupil of the eyes.

Fig 1

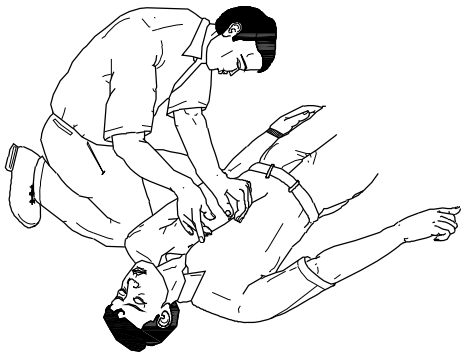


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2 Lay the victim on his back on a firm surface.

3 Kneel alongside facing the chest and locate the lower part of the breastbone. (Fig 2)

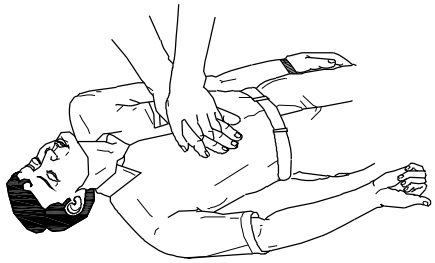
Fig 2



CE20N1103Z2

4 Place the palm of one hand on the centre of the lower part of the breastbone, keeping your fingers off the ribs. Cover the palm with your other hand and lock your fingers together as shown in Fig 3.

Fig 3



CE20N1103Z3

5 Keeping your arms straight, press sharply down on the lower part of the breastbone; then release the pressure. (Fig 4)

Fig 4

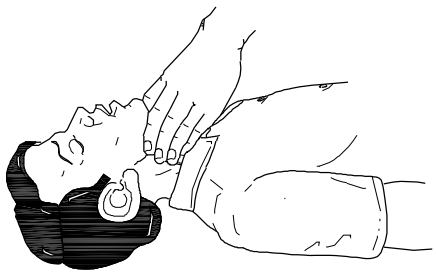


CE20N1103Z4

6 Repeat step above, fifteen times at the rate of atleast once per second.

7 Check the cardiac pulse. (Fig 5)

Fig 5



CE20N1103Z5

8 Move back to the victim's mouth to give two breaths (mouth-to-mouth resuscitation). (Fig 6)

Fig 6



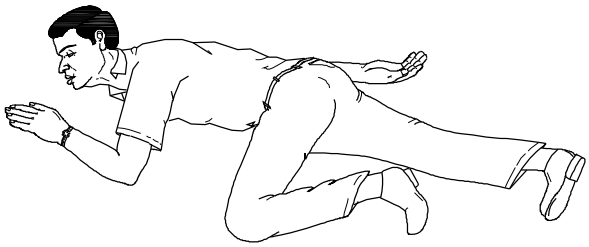
CE20N1103Z6

9 Continue with another 15 compressions of the heart followed by a further two breaths of mouth-to-mouth resuscitation, and so on, check the pulse at frequent intervals.

10 As soon as the heartbeat returns, stop the compressions immediately but continue with mouth-to-mouth resuscitation until natural breathing is fully restored.

11 Place the victim in the recovery position as shown in Fig 7. Keep him warm and get medical help quickly.

Fig 7



CE20N1103Z7

Other steps

12 Send word for a doctor immediately.

13 Keep the victim warm with a blanket, wrapped up with hot water bottles or warm bricks; stimulate circulation by stroking the insides of the arms and legs towards the heart.

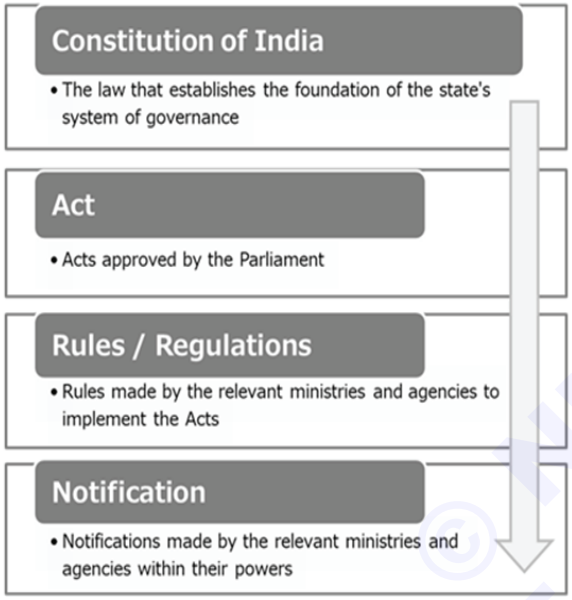
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Safety and environment guidelines

Objectives: At the end of this exercise you shall be able to
- **answer the questionaries' on legal frame work in India**
- **answer the questionaries' on health and safety in India**
- **answer the questionaries' on environment policy.**

The National Policy on Safety, Health and Environment at workplace to eliminate the incidence of work related injuries, diseases, fatalities, disaster and loss of national assets. It aims to not only ensure achievement of a high level of occupational safety, health and environment performance through proactive approaches but also to enhance the well-being of the employee and society at large.

Fig 1



Legal Framework

The main legal regime in India is shown in the following chart. The Indian legal system consists of Acts approved by the Parliament, Rules made by the relevant ministries and agencies to implement the laws, and Notifications made by the relevant ministries and agencies within their powers.

The main laws and regulations relating to occupational health and safety in India are as follows.

" Factories Act, 1948

The Factories Act, 1948 was enacted for the purpose of controlling occupational safety and health in factories and regulates the safety, health and welfare of the workers. The Act empowers the states to prescribe their implementing rules and regulations and many states have prescribed them.

e.g.

- Tamil Nadu Factories Rules, 1950
- Maharashtra Factories Rules, 1963
- Karnataka Factories Rules, 1969
- Explosive Act, 1884

The Explosives Act, 1884 was enacted to regulate the manufacture, possession, use, sale, transportation and import and export of explosives. Under this Act, the Central Government may prohibit the manufacture, possession and importation of explosives which may be deemed dangerous.

- Explosive Rules, 2008

The Explosives Rules, 2008 were enacted to regulate the manufacture, import, export, transport and possession for sale, sale or use of explosives. Other subordinate regulations of the Explosives Act 1884 include the following.

- Calcium Carbide Rules, 1987
- Ammonium Nitrate Rules, 2012
- Gas Cylinders Rules, 2016
- Static and Mobile Pressure Vessels (Unfired) Rules, 2016
- Petroleum Act, 1934

The Petroleum Act, 1934 regulates the importation, transportation, storage, production, refining and blending of petroleum. Under this Act and its subordinate legislation, the Petroleum Rules, 2002, any person importing or storing petroleum must obtain a license.

- Petroleum Rules, 2002

The Petroleum Rules, 2002 sets provisions for the approval of refineries and processing plants, authorization for the transportation of petroleum by water, land and pipelines, and for the containers in which petroleum is stored. These Rules have also been partially amended by the Petroleum (Amendment) Rules, 2011.

Fire Prevention

In India, laws and regulations related to firefighting equipment are not set at the national level, but each state government has its own fire prevention act and its implementing regulations. For example, Delhi has formulated the Delhi Fire Service Act, 2007 and the Delhi Fire Service Rules 2010.

Boilers

In India, Regulations for boiler equipment are also set out as follows.

- Boilers Act, 1923
- Boiler Regulations, 1950
- Boiler Operation Engineers Rules, 2011
- Boilers Attendants Rule, 2011
- Boiler Appeal Rules, 2013

Effective housekeeping results in

- reduced handling to ease the flow of materials.

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- fewer tripping and slipping incidents in clutter free and split-free work areas.
- decreased fire hazards.
- lower worker exposures to hazardous (e.g. dusts, vapours)
- better control of tools and materials, including inventory and supplies.
- more efficient equipment clean up and maintenance.
- better hygienic conditions leading to improving preventive maintenance.
- more effective use of space
- reduced property damage by improving preventive maintenance
- less janitorial work.
- improved morale.
- improved productivity (tools and materials will be easy to find).

Good housekeeping reduces illnesses and injuries and promotes positive behaviors, habits, and attitudes. An effective housekeeping program is an important element in workplace safety and health management systems, according to the occupational safety and health administration (OSHA)

Fewer tripping and slipping incidents in clutter-free and spill-free work areas

Reduced fire hazards. Decreased worker exposures to hazardous products (e.g. dusts, vapours). Greater control of tools and materials, including inventory and supplies.

It reduces slip and trip hazards:

Experience has shown me that slip and trip incidents in the workplace account for a large percentage of injuries. Clean up now and get the immediate benefits.

Environmental Policy

In addition to the Constitution, which provides for environmental protection, India developed the following environmental policies.

- National Forest Policy, 1988
- Policy Statement on Abatement of Pollution,1992
- National Conservation Strategy and Policy Statement on Environment and Development, 1992
- National Water Policy, 1987, 2002, 2012

The National Environment Policy, 2006 was formulated based on these policies. The objectives of the policy are as follows.

1 Conservation of endangered environmental resources
2 Guaranteeing the livelihoods of the poor (ensuring access to resources)
3 Sustainable use of resources
4 Integration of environmental issues with economic and social development
5 Efficient use of resources
6 Improvement of environmental governance
7 Improvement of resources for environmental conservation

Ministry of Environment, Forest and Climate Change is as the implementing agency for the policy.

These policies are not legally binding, but serve as guidelines for the central and state governments.

Note

The trainees shall read the contents and answer the following questions

Legal frame work

1 What is act?

---

2 What is rules / regulation?

---

3 What is notification?

Occupational health and safety

1 List the other occupational health and safety act?

---

2 State the purpose of Factories Act, 1948?

Environment policy

1 List the objectives of the environment policy

— — — — — — — —

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Disposal procedure of waste materials of the trade

Objectives: At the end of this exercise you shall be able to
- **identify and segregate the waste material in workshop**
- **arrange the waste material in different bins.**

PROCEDURE

TASK 1: **Disposal of waste material**

- Separate the cotton waste.
- Collect the chips by hand shovel with the help of brush. (Fig 1).
- Clean the floor, if oil is spilled.

Do not handle the chip by bare hand

There may be different metal chips. So separate the chip according to metal.

- Separate the cotton waste material and store it in the bin provided to store the waste cotton material. (Fig 2)
- Similarly store the each category of metal chip in separate bins.

Each bin should have name of the material.

Fig 1

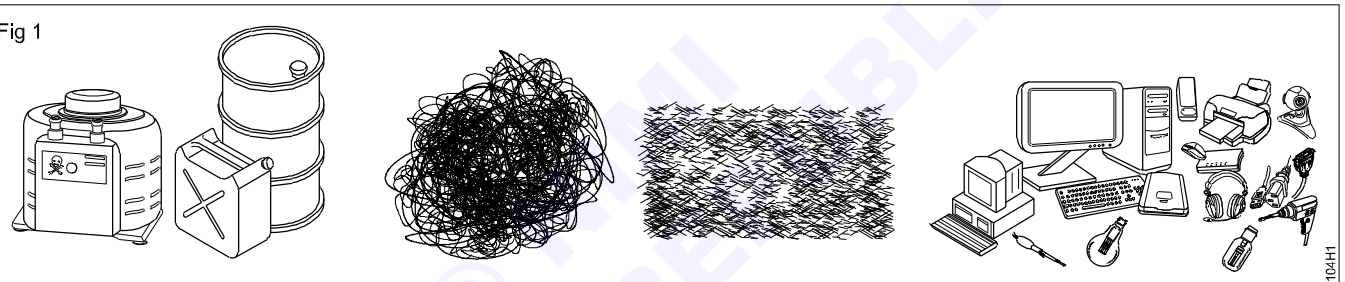
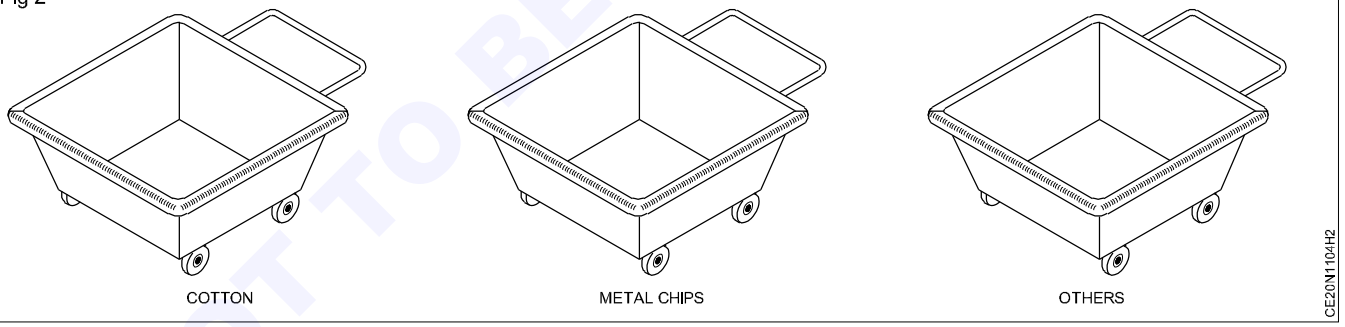


Fig 2



Identify the material given in Fig 1 and fill in table 1

Table1

S. No.	Name of the material
1	
2	
3	
4	
5	

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Personal protective equipment (PPE): Basic injury prevention

Objectives: At the end of this exercise, you shall be able to
- **identify personal protective devices**
- **interpret the different types of personal protective devices.**

PROCEDURE

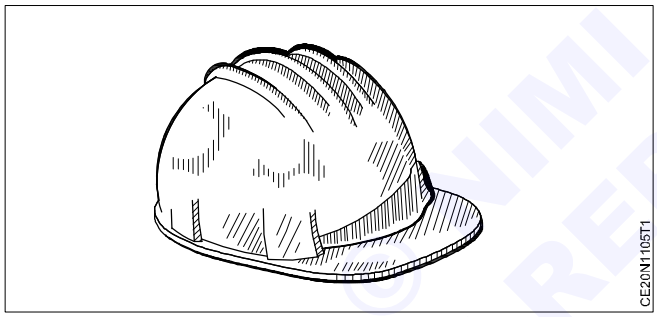
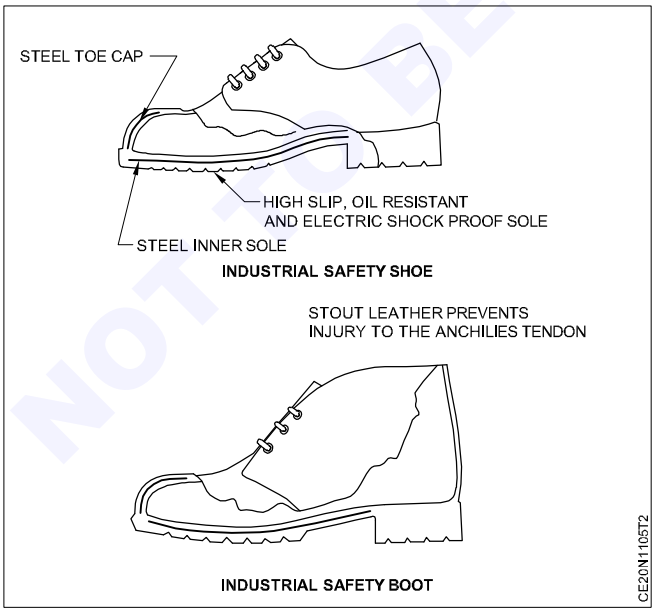
TASK 1: **Explaining each PPE**

Instructor may arrange the available different types of PPEs in the table (or) provide the chart showing the PPEs. Explain the types of PPEs and their uses for corresponding hazards.

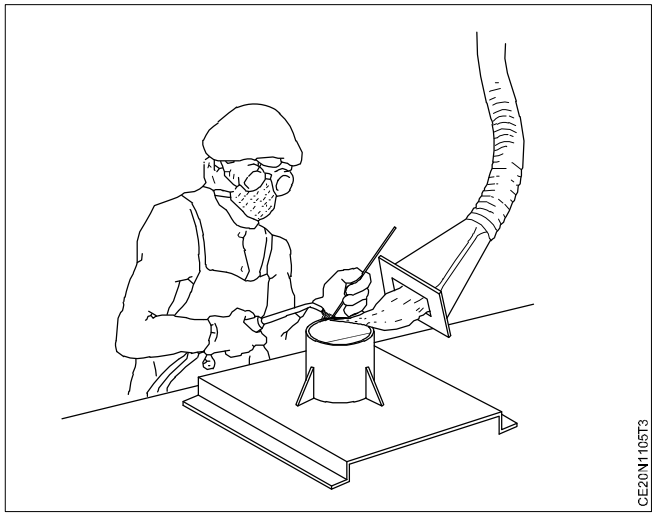
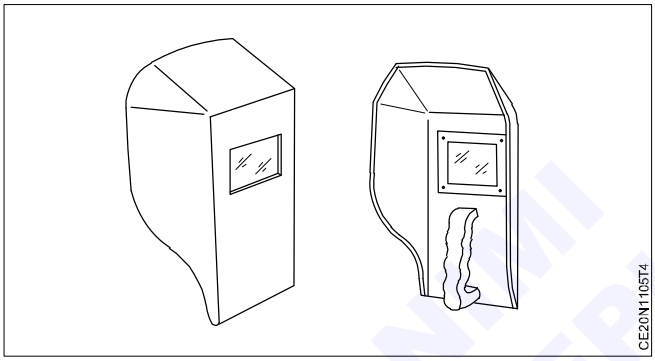
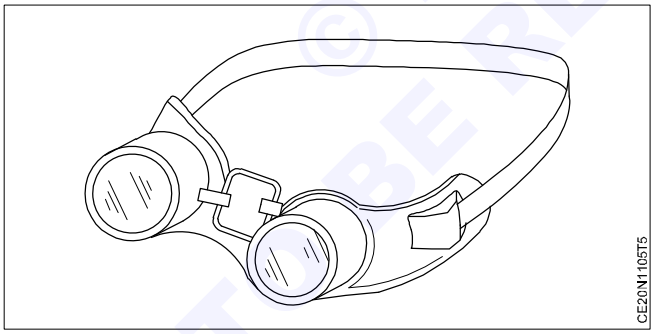
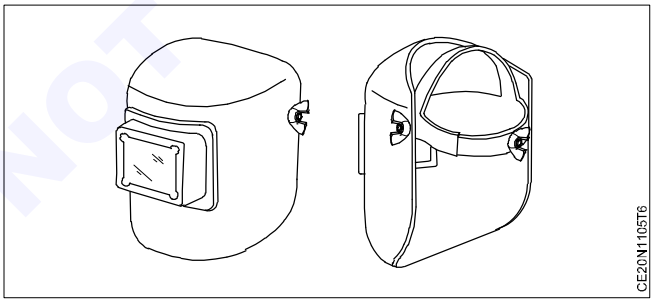
1 Identify the type of PPEs and write their names to the corresponding PPE, by referring from chart (or) read PPEs in Table 1.

2 Write their type of protection and uses in the blank space provided against each PPE in Table 1.

Table 1

Sl. No.	Sketches	Name of PPE	Type of protection	Uses
1				
2				

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Sl. No	Sketches	Name of PPE	Type of protection	Uses
3	 CE20N1105T3			
4	 CE20N1105T4			
5	 CE20N1105T5			
6	 CE20N1105T6			

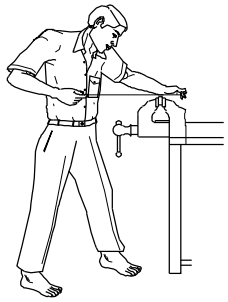
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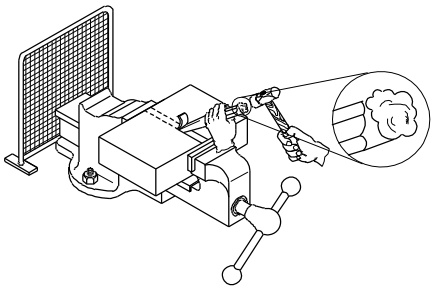
Hazard identification and avoidance ,safety signs

Objectives: At the end of this exercise you shall be able to
- **identify the occupational hazards**
- **suggest suitable methods to avoid occupational hazards.**

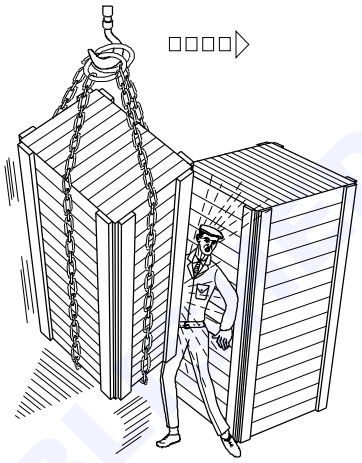
Fig 1



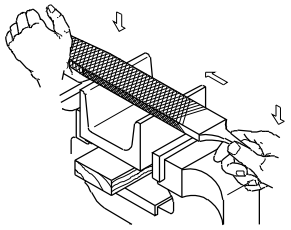
1 WORKING BARE FOOT IN SHOP FLOOR



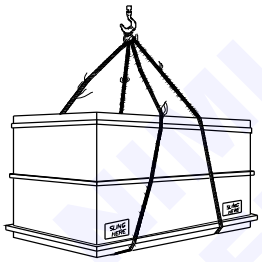
5 CHIPPING METAL SURFACE WITH MUSHROOM HEAD CHISEL



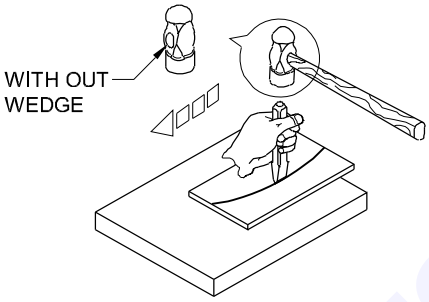
8 LIFTING A LOAD WHILE PEOPLE WORKING NEARBY



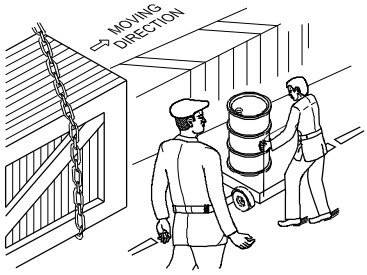
2 USING FILE WITHOUT HANDLE



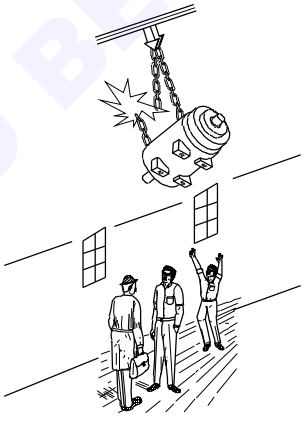
6 LIFTING LOAD WITH DAMAGED SLINGS



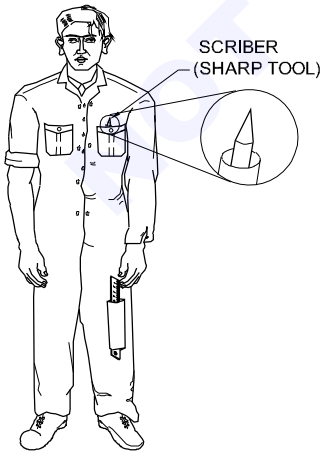
3 STRIKING ON CHISEL HEAD WITH BALL PEIN HAMMER WITHOUT WEDGE



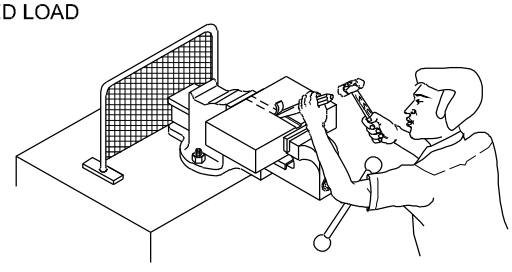
9 NO OBSTACLE WHILE MOVING THE LOAD



7 STANDING BELOW A SUSPENDED LOAD



4 KEEPING SCRIBER SHARP EDGE OPEN IN POCKET



10 CHIPPING ON METAL SURFACE WITHOUT SAFETY GOGGLES

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PROCEDURE

The instructor shall emphasise the importance of hazard and avoidance to the students and insist them to follow properly.

- Study the drawing of industrial hazards.
- Identify the type of hazards.
- Name the hazards against their names.
- Record the hazards and avoidance in Table 1.
- Get it checked by your instructor

Table 1

S. No.	Identification of hazards	Avoidance
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Safety sign for danger, warning, caution and personal safety message

Objectives: At the end of this exercise you shall be able to
- **identify the basic categories of safety sign**
- **record the meaning of safety sign in the table given. Safety sign for danger, warning, caution and personal safety message.**

Instructor shall provide various safety signs, chart categories and explain their meaning, description. Ask the trainee to identify the sign and record in Table 1.

- Identify the safety sign from the chart.
- Record the name of the category in Table 1.
- Mention the meaning description of the safety sign in Table 1.

Table 1

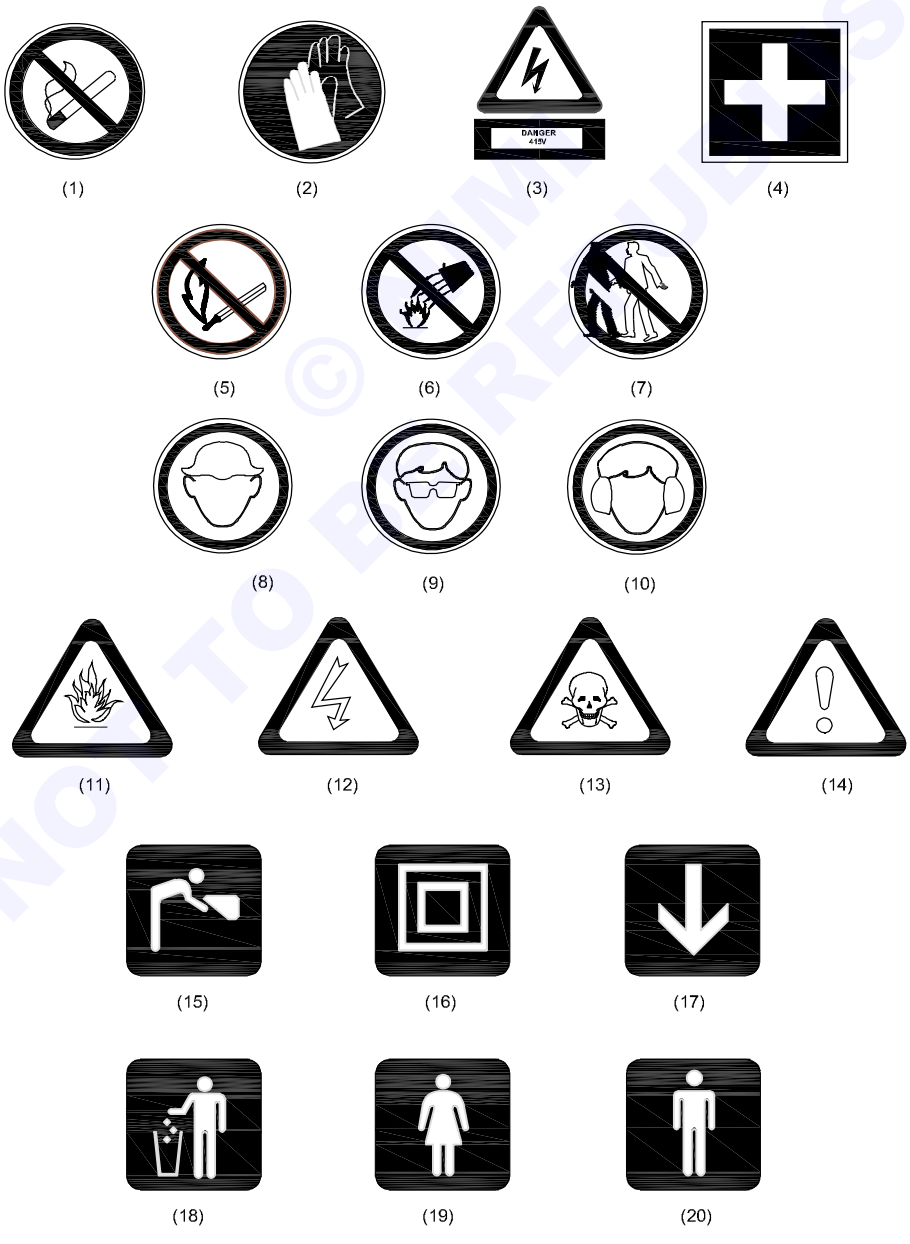
Fig. No.	Basic Categories/Safety sign	Meaning - description
1		
2		
3		
4		
5		
6		
7		
8		
9		

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Fig. No.	Basic Categories/Safety sign	Meaning - description
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

- Get it checked by your instructor.

Fig 2



CE20N1106H2

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Electrical safety preventive measure for electrical accidents and practice steps to be taken in such accidents

Objectives: At the end of this exercise you shall be able to
- **practice and follow the preventive safety rules to avoid electrical accident**
- **perform the immediate steps to save the electric shocked victim.**

Note: The instructor shall arrange suitable electrical safety poster/chart/slogan appropriate to this exercise

PROCEDURE

TASK 1: **Preventive measures for electrical accidents**

1 Never touch any electrical apparatus /machinery with wet hands or while standing in water.

2 If you get a tingle or shock when touching any electrical item, a sink, tub, or other wet area, turn off the power at the main panel and immediately call an electrician.

3 Don't use damaged or broken cords/ wires or plug in anything with a missing prong.

4 When unplugging, don't pull the cord; pull it by the plug.

5 Don't overload sockets; use a power extension board with a safety switch.

6 Know the location and how to operate shut-off switches and/or circuit breaker panels. Use these devices to shut off equipment in the event of a fire or electrocution.

7 Avoid for water or chemical spills on or near electrical equipment. Wear rubber shoes in wet areas.

8 Cover unused outlets and keep metal objects away from outlets. you should always take extra care to ensure that you do not come into contact with the exposed live wires as this runs the risk of shock and burns.

9 Put a notice nearby to the appliance to inform others of the danger and to ensure that it is protected until you are able to schedule repairs.

10 Use safe work practices every time electrical equipment is used.

11 All electrical installations regardless of whether at home or in the workplace, must be grounded, which is otherwise known as earthing to track down any excess electricity, the most effective route to return to the ground without posing any safety risks.

12 It is safe to work on the electrical equipment that is plugged in with only dry hand and wear non-conductive gloves and insulated-soles shoes.

13 Disconnect the device from the source in the period of service or maintenance of the device.

14 Disconnect the power source before servicing or repairing electrical equipment.

15 All electrical cords should have sufficient insulation to prevent direct contact with wires.

16 In a laboratory/workshop it is particularly important to check all cords before each use, since corrosive chemicals or solvents may erode the insulation.

17 Damaged cords should be repaired or taken out of service immediately, especially in wet environments such as cold rooms and near water baths.

18 Keep away from the energized or loaded circuits Arcing, sparking, or smoking from the equipment

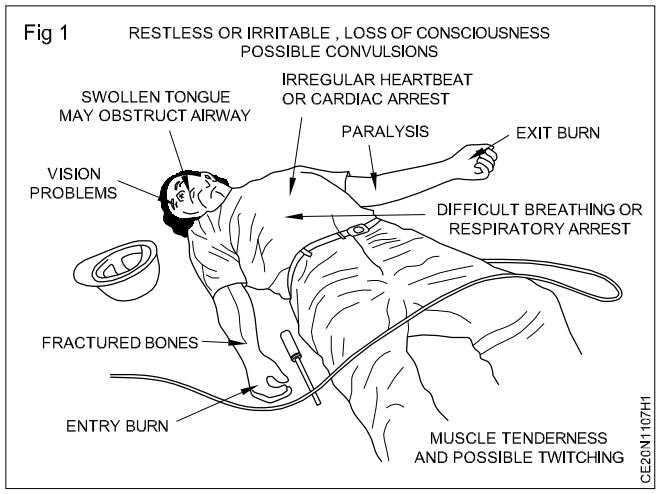
19 If the device interacts with water or other liquid chemicals, equipment must be shut off power at the main switch or circuit breaker and unplugged.

20 If any individual comes in contact with a live electric line, do not touch the individual or equipment / source/ cord; disconnect the power source from the circuit breaker or pull out the plug using a leather belt.

21 always stay at least ten feet away from the overhead power lines, carry highest voltage, which means that should anyone come into contact with them, there is a significant risk of not only electrocution but also severe burns.

First Aid for Accidental Electric Shock Victims (Fig 1)

Fig 1



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1 Ensure that you are taking sufficient safety precaution to protect yourself before going to help the other person met with accidental electric shock.

2 Talk to the person and ask loudly, "Are you OK?"; make him feel comfortable.

3 Check for ventilation and airways; clear obstruction and provide fresh air flow.

4 Check for signs of normal breathing; observe breathing.

5 If not breathing normally, begin CPR

6 Unplug the appliance or turn off the power at the control panel.

7 If you can't turn off the power, use a dry wooden piece, like a broom handle, dry rope or dry clothing, to separate the victim from the electrical contact / power source.

8 Do not try to move the victim touching a high voltage wire; Call for emergency help/immediate superior for assistance.

9 Unconscious victims should be placed on their side to allow drainage of fluids; Keep the victim lying and observe for the symptoms shown in Fig.1

10 Do not move the victim if there is a suspicion of neck or spine injuries call for the ambulance service.

11 If the victim is not breathing, apply mouth-to-mouth resuscitation. If the victim has no pulse, begin cardiopulmonary resuscitation (CPR). Then cover the victim with a blanket to maintain body heat, keep the victim's head low and get medical attention.

First aid for accidental electrical burn victims

Electrical burns vary in severity depending upon the following conditions

1 how long the victim is in contact with the electric current;

2 the strength of the current flow;

3 the type of current AC or DC; and

4 the direction of the current takes through the body.

5 Observe the person, if the person is conscious and there are no signs of shock (such as being cold, clammy, pale and having a rapid pulse)

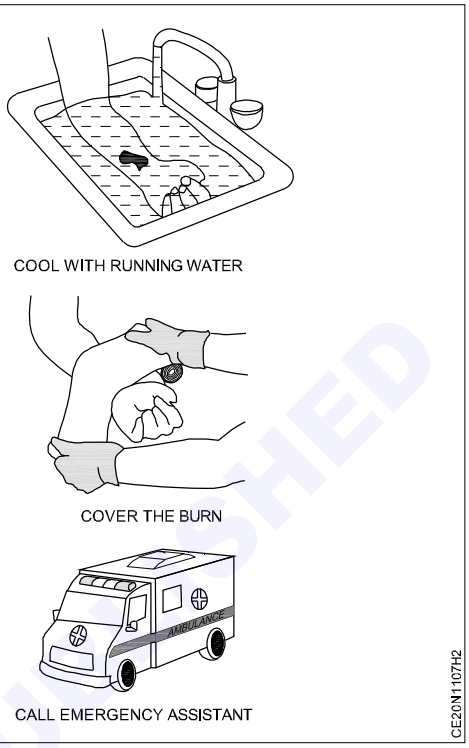
6 Do not apply grease or oil to the burn.

7 Cover the burn with a dry, sterile dressing.

8 There may be more than one area burned.

9 If the person has electrical burn, check for shock and follow the outlined points shown in (Fig 2)

Fig 2



10 Keep the victim from getting chilled; Seek medical attention as soon as possible.

Accidental electrical fire

1 Keep flammable materials away: Electrical appliances or outlets that come into contact with flammable materials that may trigger a fire.

2 Inspect electrical wiring: Have your electric wiring checked to prevent electrical fires. Wiring does not last forever, so it is a good idea to have your wiring checked

3 Be wary of certain appliances: If an appliance blows a fuse, trips a circuit, or sparks while being used, unplug the appliance immediately, and check to see if it needs to behave it repaired or replaced.

4 Check Switches or outlets that are hot to touch and/or emit an acid odour; Inspect and repair outlets and switches.

5 In case of electrical fire, use only CO_2 type of Fire extinguisher.

— — — — — — — —

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Use of fire extinguishers

Objectives: At the end of this exercise you shall be able to
- **select the fire extinguisher according to the type of fire**
- **operate the fire extinguisher.**

PROCEDURE

TASK 1: **Uses of fire extinguishers**

Extinguishing fire

1 Alert people surrounding by shouting fire, fire, fire.

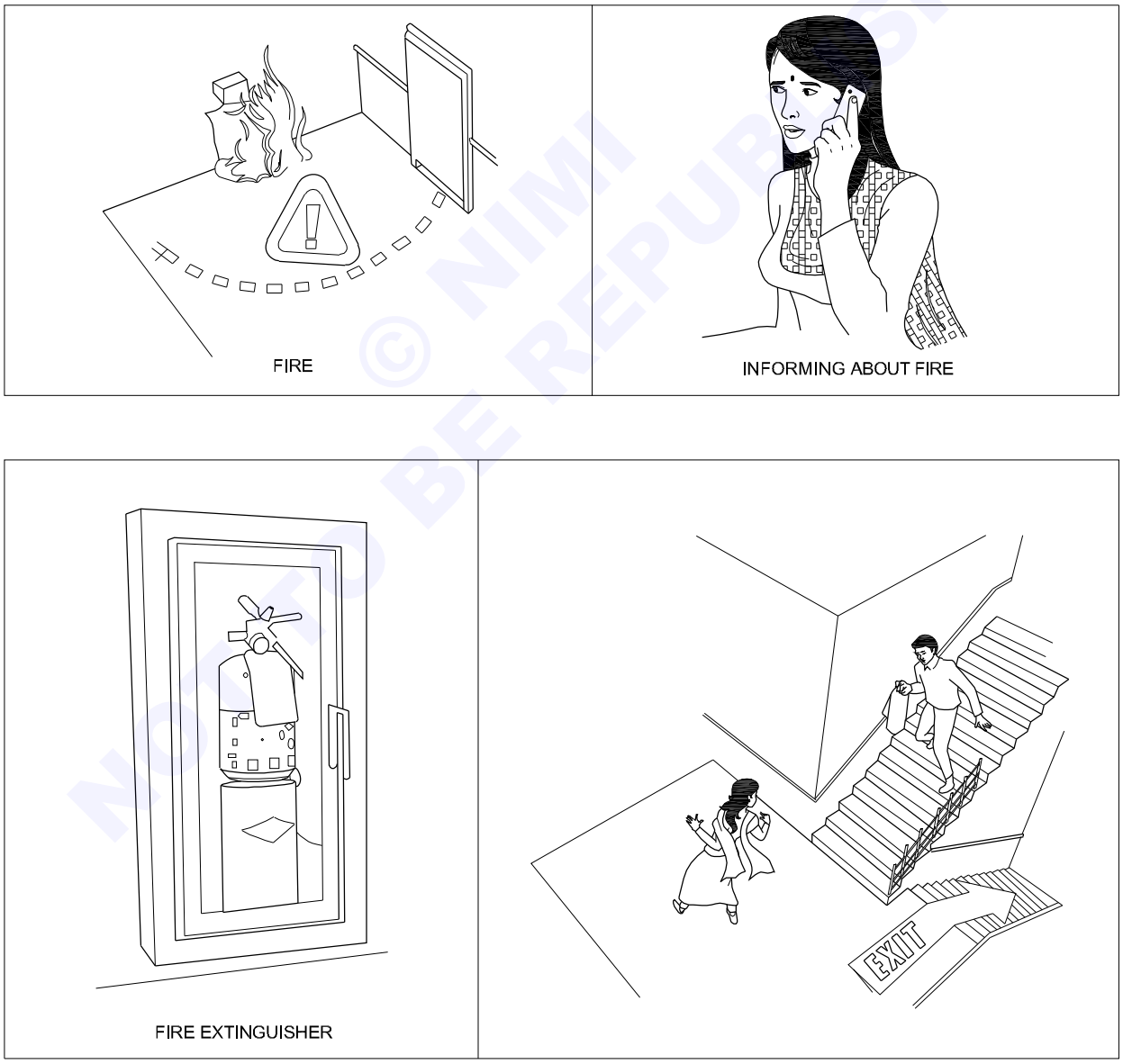
2 Inform fire service or arrange to inform immediately.

3 Open emergency exist and ask them to go away.

4 Analyze and identify the type of fire. Refer Table1.

All fire extinguisher are labelled to indicate which class of fire they are designed to combat.

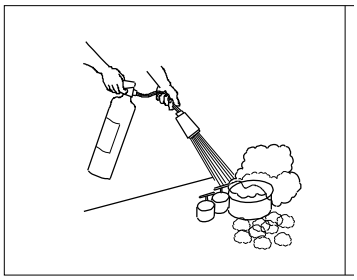
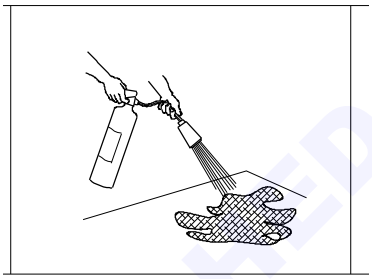
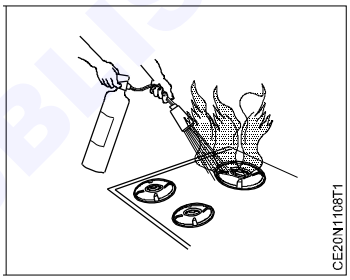
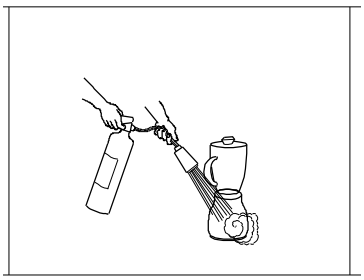
Fig 1



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Table1

Class 'A'	Wood, paper, cloth, solid material	
Class 'B'	Oil based fire (grease, gasoline, oil) & liquefiable solids	
Class 'C'	Gas and liquefied gases	
Class 'D'	Metals and electrical equipment	

Assume the fire is 'B' type (flammable liquefiable solids)

5 Select CO_2 (carbon dioxide) fire extinguisher

6 Locate and pick up CO_2 fire extinguisher. Check for its expiry date.

7 Break the seal.

Stand back: Face the fire and keep your back to the exit stay between six and eight feet away from flame.

Operator: Operate the fire extinguisher

Most of the fire extinguisher operator the same basic way stand six to eight feet away from the fire and remember to PASS - PULL - AIM - SQUEEZE - SWEEP.

PULL the pin: This will allow you to discharge the extinguisher. (Fig 1)

AIM at the base of fire: If you aim at the flames (Which is frequently the temptation). The extinguishing agent will fly right through and do no good. (Fig 2)

Squeeze the top handle or lever: This depress a button that releases the pressurised extinguishing agent in the extinguisher.

Sweep from side to side until the fire is completely put off. Start using the extinguisher from distance away. Then move forward. Once the fire is put off keep on eye on the area incase re-ignite.

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Awareness of the job sheet made by the Ex-trainees

Objectives: At the end of this exercise you shall be able to
- **identify the features of a pitched roof & building**
- **identify the details and construction features of a mangalore tiled residence**
- **study a R.C.C sloped building.**

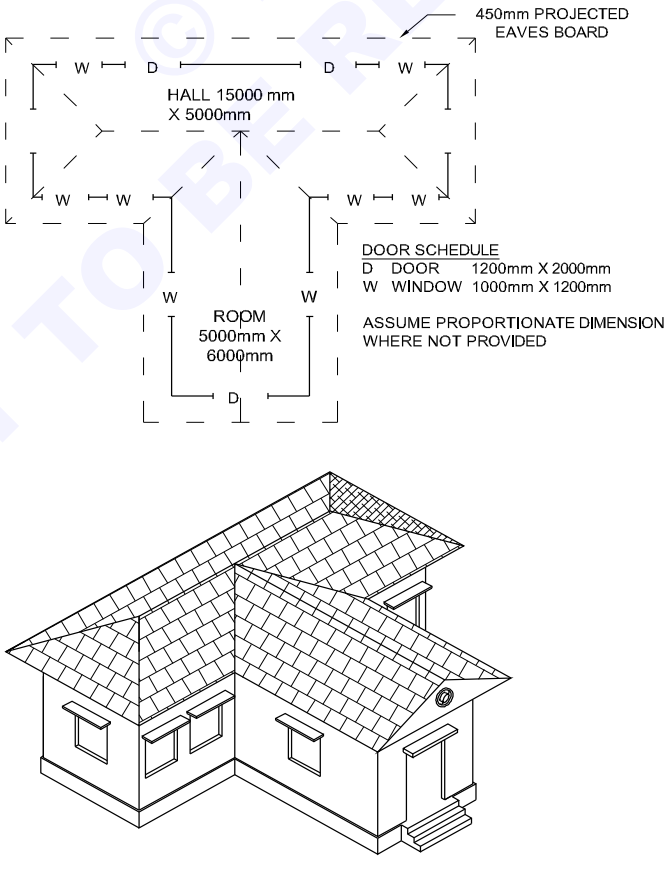
PROCEDURE

TASK 1: **Awareness of the job sheet made by the Ex-trainees**

1 The instructor should explain the following job sheets (Fig 1 & 2) made by the ex-trainees to create the awareness among the trainees about the building drawing / job sheet which they are all going to execute in future training activities.

- Offset the building outline and 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 100 cm door draw a line perpendicular to the wall, offset 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 dimensions icon and click the edges of each wall that you would like to dimension too. 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

Fig 1

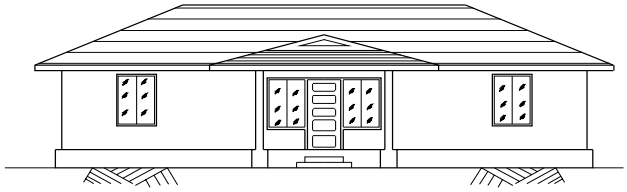


ISOMETRIC & ORTHOGRAPHIC PROJECTION

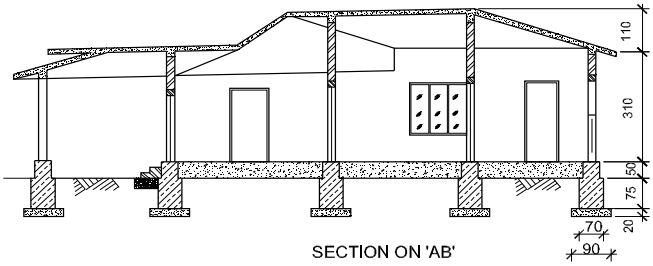
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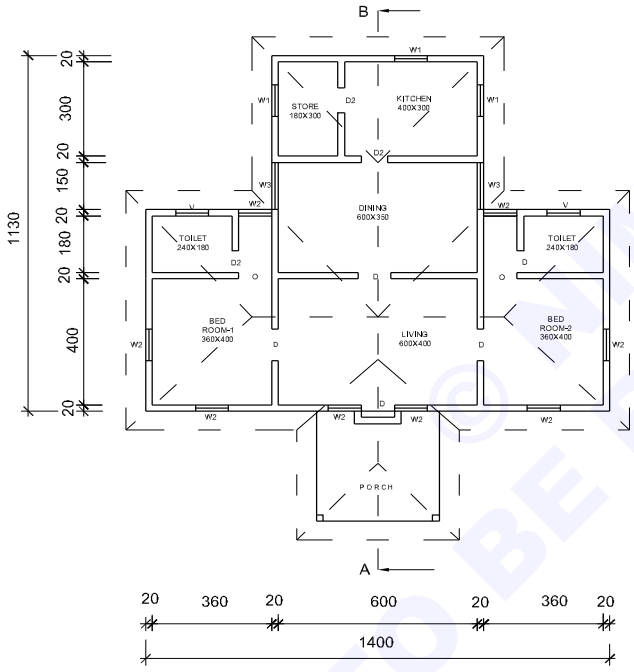
Fig 2



ELEVATION



SECTION ON 'AB'



REFERENCE:

FOUNDATION	:- R R MASONRY IN CM 1:6. 70CM WIDE 75CM DEEP OVERA LEVELLING COURSE OF PCC 1:4:8. 20CM THICK
BASEMENT	:- R R MASONRY IN CM 1:6. 50CM WIDE 50CM HEIGHT
SUPERSTRUCTURE:-	:- BRICK MASONRY IN 1:6 20CM THICK BOTH SIDE PLASTERED WITH CM 1:4 RCC LINTELS 15CM THICK ARE PROVIDED OVER ALL OPENEINGS
ROOF	:- RCC 1:11/2:3 SLAB , 12CM THICK

INDEX

MD	- MAIN DOOR WITH WINDOW (SINGLE SHUTTER NO EITHER SIDE) (110x210,60x180 CM
D	- DOOR (100x210CM)
D1	- DOOR (90x210CM)
W1	- WINDOW (100x100CM)
W2	- WINDOW (100x150CM)
W3	- WINDOW (150x150CM)
V	- VENTILATOR (100x60CM)

ASSUME SUITABLE DATA IF NECESSARY

R.C.C SLOPED ROOF

CE20N1209H2

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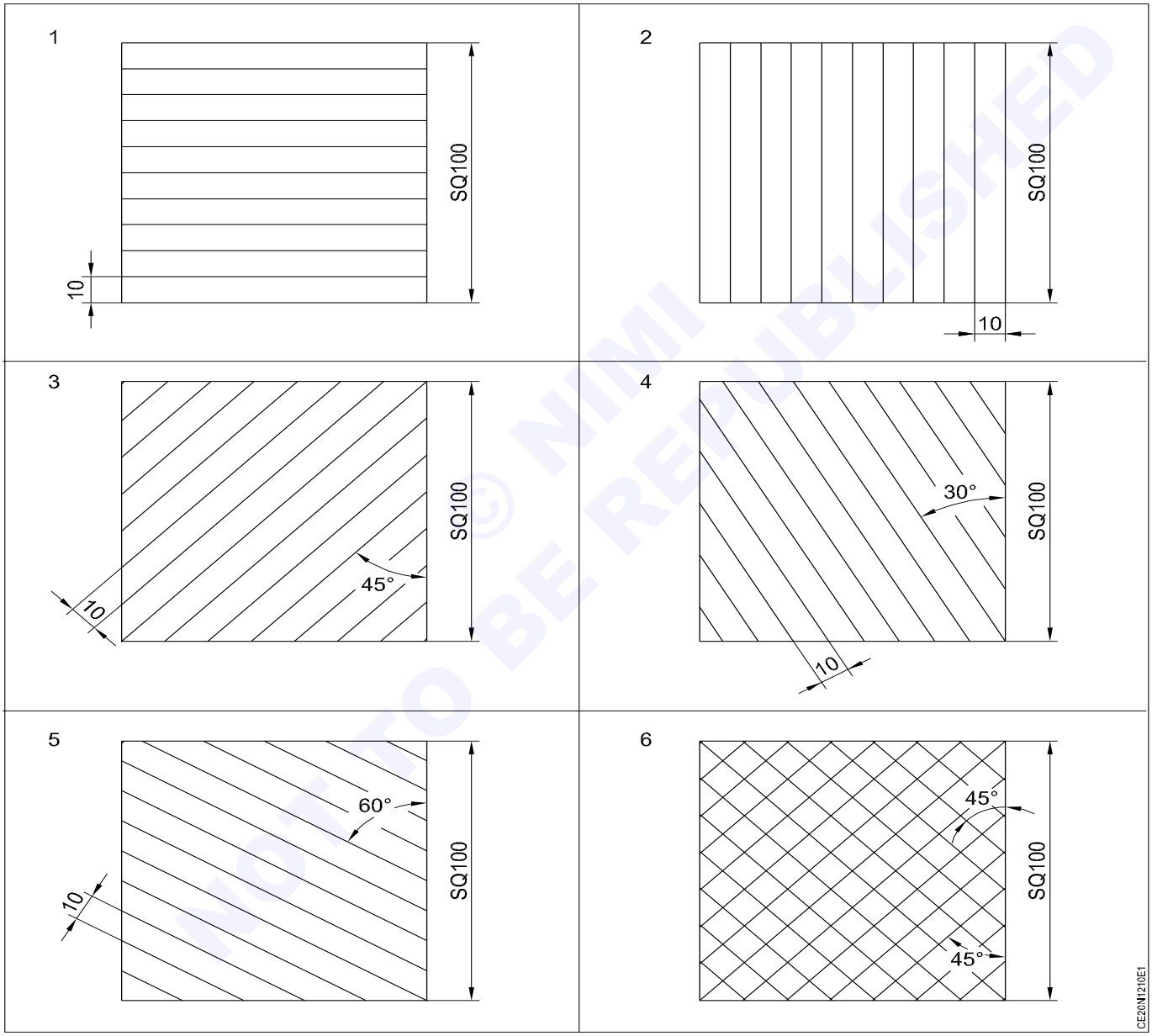
Use of drawing instrument and equipment with care (line, angle and patterns)

Objectives: At the end of this exercise you shall be able to
- **draw figures involving horizontal, vertical and inclined lines using drawing instruments**
- **independently using 'T' square, setsquares, scale, divider and protractor.**

PROCEDURE

TASK 1: **Draw the following exercises of patterns and components using straight lines**

Exercise 1 to 6 : Draw the following patterns and components using straight lines.

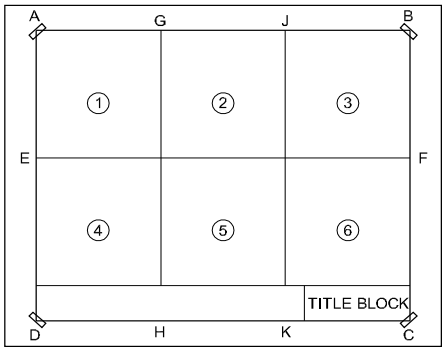


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Exercise 1 : Horizontal line

1 Layout lines as shown in Fig 1 on an A2 drawing sheet.

Fig 1

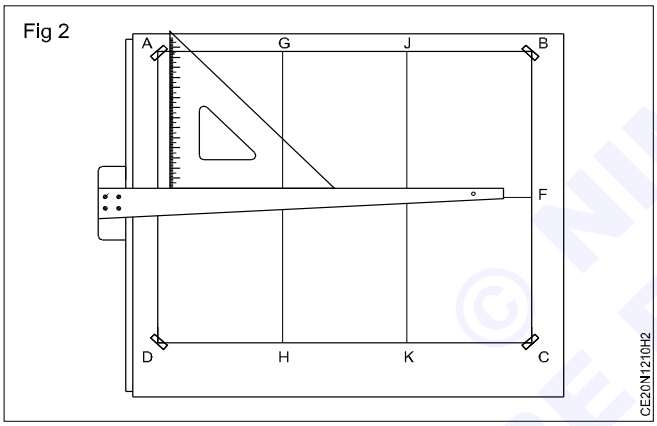


2 Butt the 'T' square approximately 5 mm above the line EF.

3 Draw a horizontal line 100 mm long left to right. (15 mm from AE)

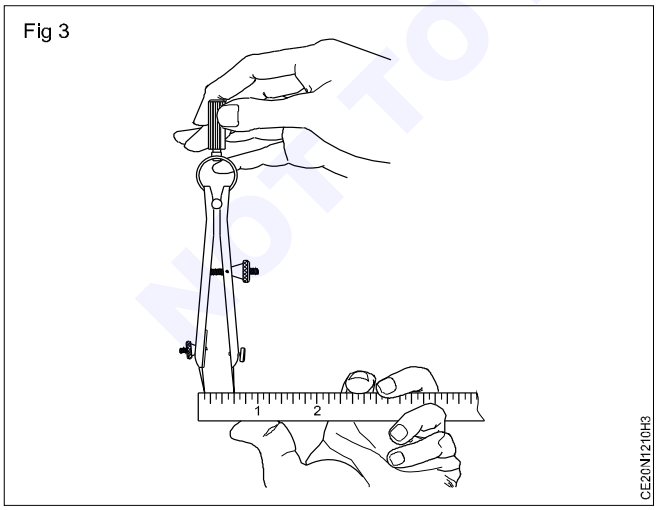
4 Draw a vertical line 100 mm long from the left end of the drawing paper as shown in (Fig 2).

Fig 2



5 Mark of points on the vertical line at 10 mm intervals using divider. (Fig 3)

Fig 3



6 Draw horizontal lines through the points using 'T' square. (Fig 4)

Exercise 2

1 Draw the thin horizontal line and mark 10 mm spaces as in (Fig 5).

Fig 4

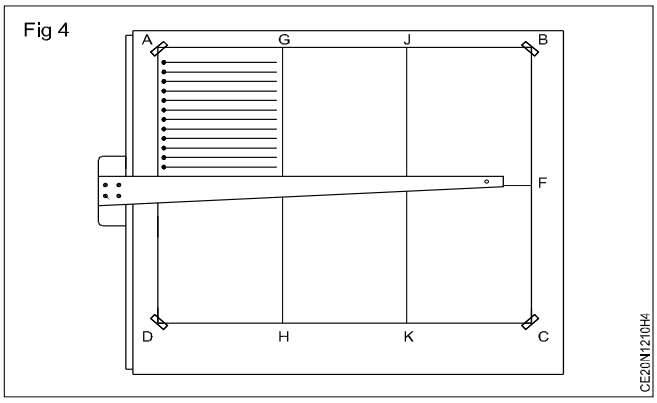
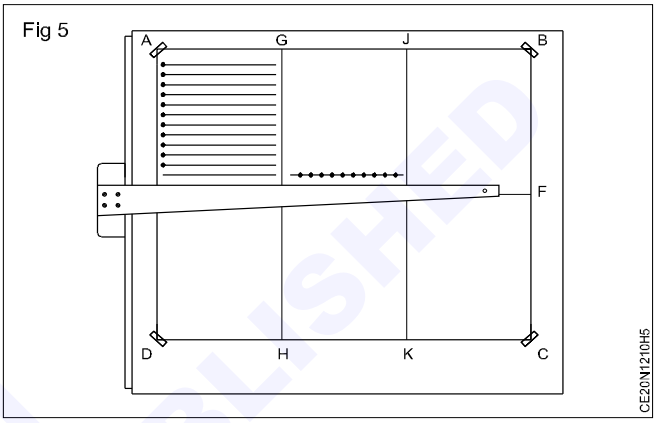


Fig 5

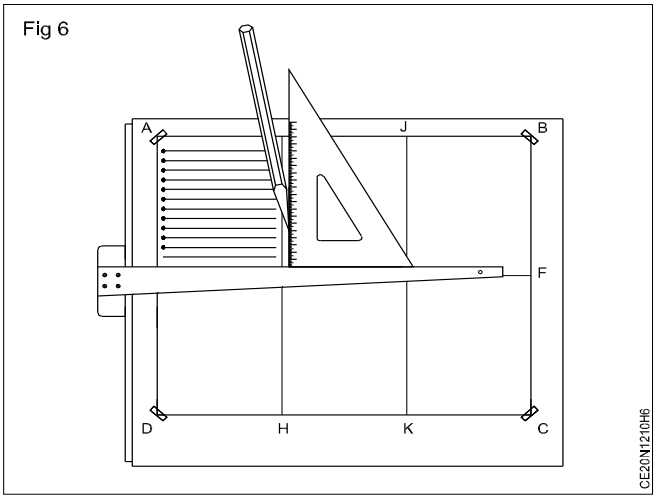


2 Place the 30°/60° setsquare on the 'T' square in such a way that its vertical edge is towards the left side of the board, approximately 15 mm from the line GH. (Fig 6)

3 Move your left hand onto the 'T' square blade and hold the set square firmly in position.

4 Hold the pencil approximately at 60° with the paper. (Fig 6)

Fig 6



5 Draw a line upwards approximately to a height of 100 mm twisting your body as shown in Fig 7.

6 Continue to draw the remaining vertical lines.

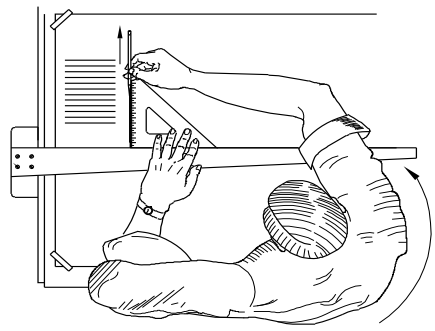
Exercise 3 to 6: Inclined lines

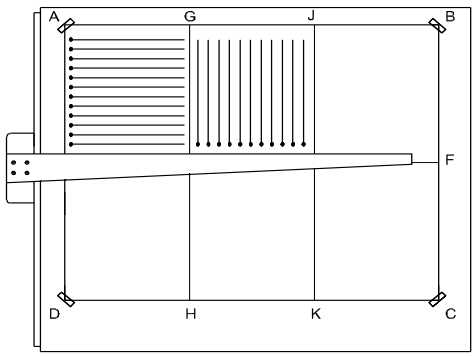
1 For drawing 45° lines.

2 Place the working edge of the 'T' square 15 mm above the line EF and draw horizontal lines in block (3) as shown.

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Fig 7



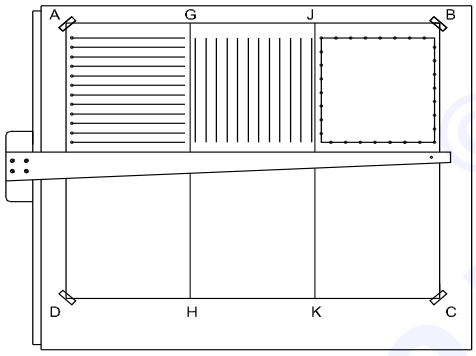


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3 Draw vertical lines parallel to JK as shown in the block.

4 Using divider, mark points from top corner at 10 mm intervals on horizontal and vertical line. (Fig 8)

Fig 8

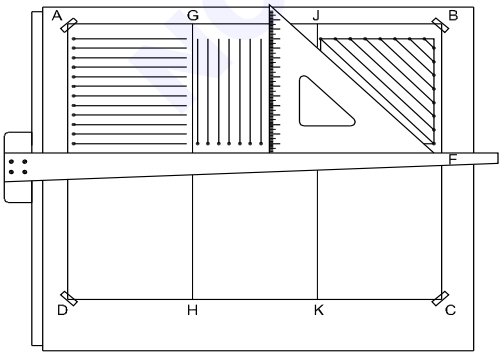


CE20N1210H8

5 Butt, slide and take the working edge of 'T' square to line EF.

6 Place the 45° setsquare and draw the 45° inclined lines from the corner, top to downwards. (Fig 9)

Fig 9



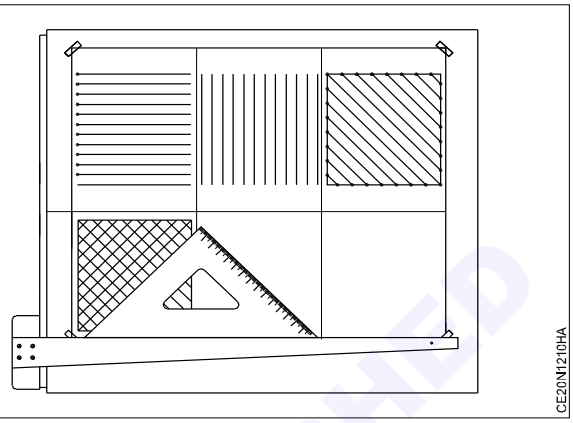
CE20N1210H9

7 Hold the blade of the 'T' square and setsquare intact while drawing lines.

8 Following the same procedure complete block 4, 5 & 6.

9 Draw 45° inclined line in the opposite direction in block 4. (Fig 10)

Fig 10

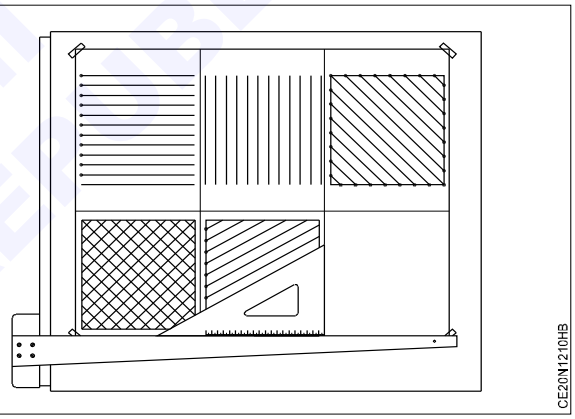


CE20N1210HA

10 30° or/and 60° inclined lines can be drawn with the help of 30° /60° setsquare and 'T' square.

11 Draw 30° inclined lines in block 5. (Fig 11)

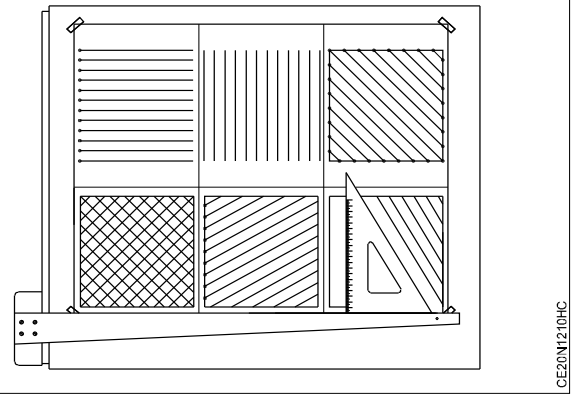
Fig 11



CE20N1210HB

12 In the block 6, draw 60° inclined lines. (Fig 12)

Fig 12



CE20N1210HC

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Method of fixing drawing sheet and folding of drawing sheet

Objectives: At the end of this exercise you shall be able to
- **fixing of drawing sheet in drawing board**
- **mark the standard folding marks on the designated drawing sheet**
- **fold the drawing sheet sequential as per marking for filing it.**

PROCEDURE

TASK 1: **Method of fixing the drawing sheet**

1 Set the drawing paper ON the board.

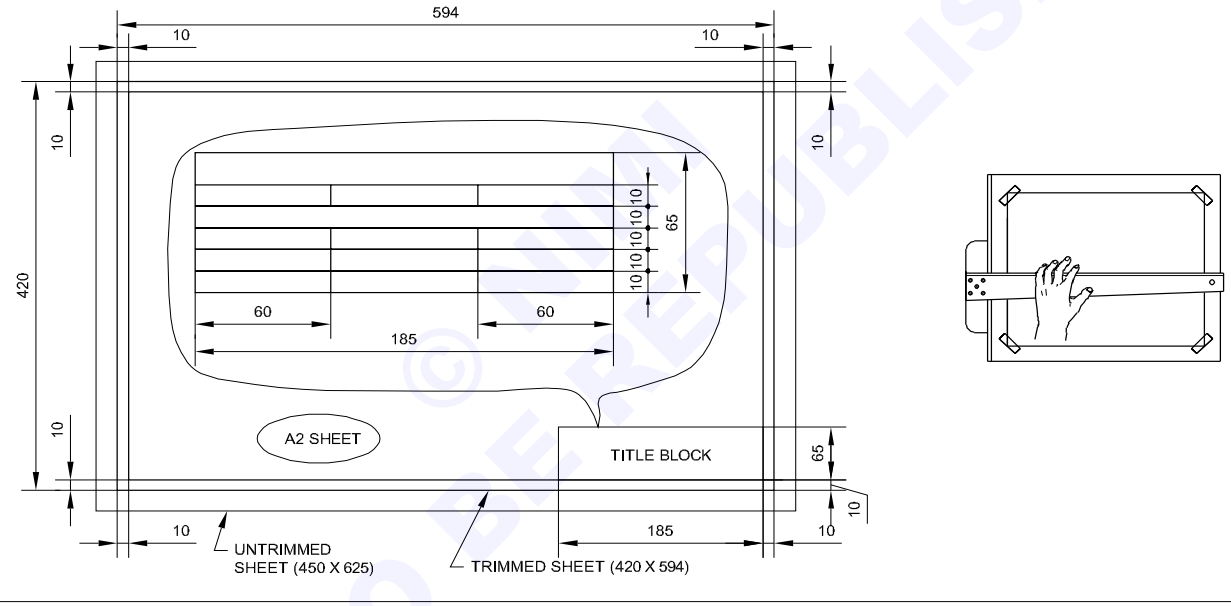
2 Top edge of the drawing paper and edge of drawing should be parallel.

3 Check the parallelism of the paper with the T -square.

4 If it found correct, fix the paper by tape.

5 If not adjust the paper with the edge of the T-square (Fig 1)

Fig 1



TASK 2: **Method of folding of drawing sheet (Fig 1)**

1 Study the sequence of marking of folds on the designated drawing sheet.

2 Start the folding in the sequence means fold vertically first.

3 Fold horizontally in such a way so that Title block to be on the top most folds for easy reference.

4 Folded drawing sheets filed neatly for submission/ reference in the file.

Fold A0 - Sheet (841X1189)

1 Observe carefully Folding marks on the drawing sheet which is started from left to right and bottom to top.

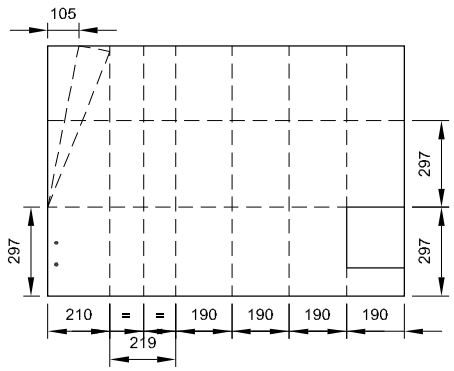
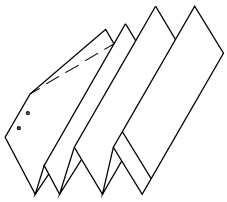
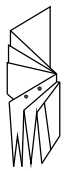
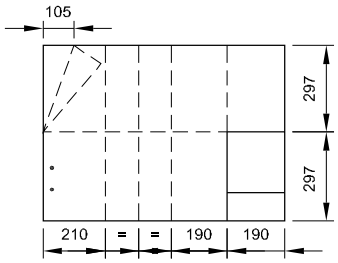
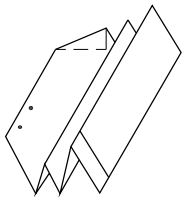
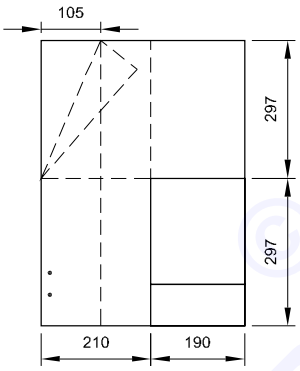
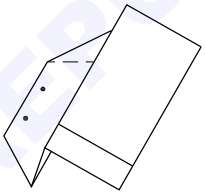
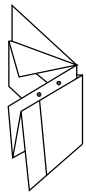
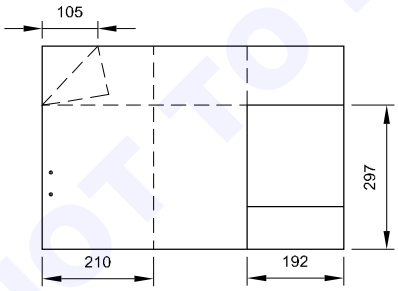
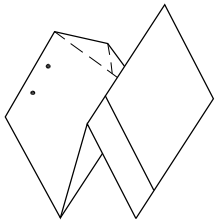
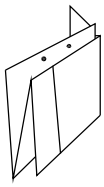
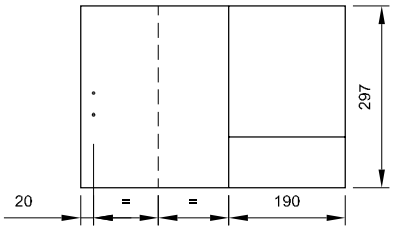
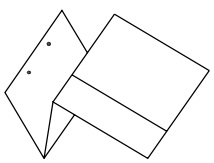
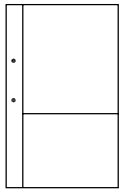
2 Start folding sequentially from left side

3 Then fold it horizontally as shown, so that title block appear on the top of right hand bottom

Practice for folding other designated drawing sheets, as marking shown in the figure.

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Fig 1

A0 **841 X 1189**			
A1 **594 X 841**			
A2 **420 X 594**			
A2 **420 X 594**			
A3 **297 X 420**			

FOLDING OF PRINTS

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CE20N1211J1

Draw free hand sketch of hand tools used in civil work

Objective: At the end of this exercise you shall be able to
- **draw the following hand tools pertaining to your trade by freehand proportionately.**

PROCEDURE

TASK 1: **Draw the following hand tools by freehand**

1 Trowel
2 Sprit level
3 Spade
4 Cross out saw
5 Line and pins
6 Wooden float
7 Metal float
8 Wooden forma (Template for skirting)
9 Face hammer
10 Club hammer
11 Masons hammer
12 Scutch
13 Mallet
14 Mash hammer
15 Mason's square

Note : Name the parts wherever needed.

Refer Exercise: 1-1-01

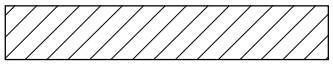
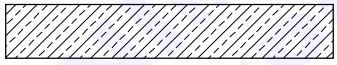
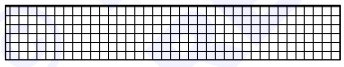
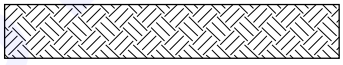
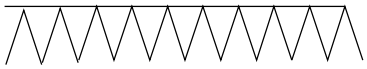
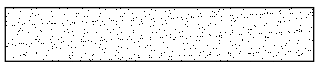
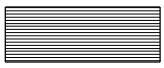
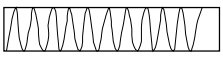
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Symbols and conventional representation for materials in sections as per IS 962 - 1989 - SP 46: 2003 for building drawings

Objectives: At the end of this exercise you shall be able to
- **identify the signs and symbols of various materials**
- **designate the colour of various materials**
- **illustrate the signs and symbols of various materials**
- **use appropriate signs and symbols for showing used materials in drawing.**

PROCEDURE

TASK 1: **Draw the symbols for various materials**

METERIAL	SYMBOL	COLOUR
BRICK		VERMILION
CONCRETE		HOOKERS GREEN
NATURAL OR RECONSTRUCTED STONE		COBALT BLUE
PARTITION BLOCKS		PAYNES GREY
WOOD		BURNT SIENNA
EARTH		SEPIA
HARDCORE		YELLOW OCHRE OR CHROME YELLOW
PLASTER AND PLASTER PRODUCTS		GREEN
GLASS	 APPLICABLE TO LARGE SCALES ONLY	BLUE
FIBRE BUILDING BOARD AND INSULATION BOARD		SEPIA
METAL SECTIONS		BLACK

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Symbols for doors and windows

Objectives: At the end of this exercise you shall be able to
- **identify the signs and symbols of various openings**
- **illustrate the signs and symbols of various types of doors and windows**
- **use appropriate signs and symbols for showing different types of openings used in drawing.**

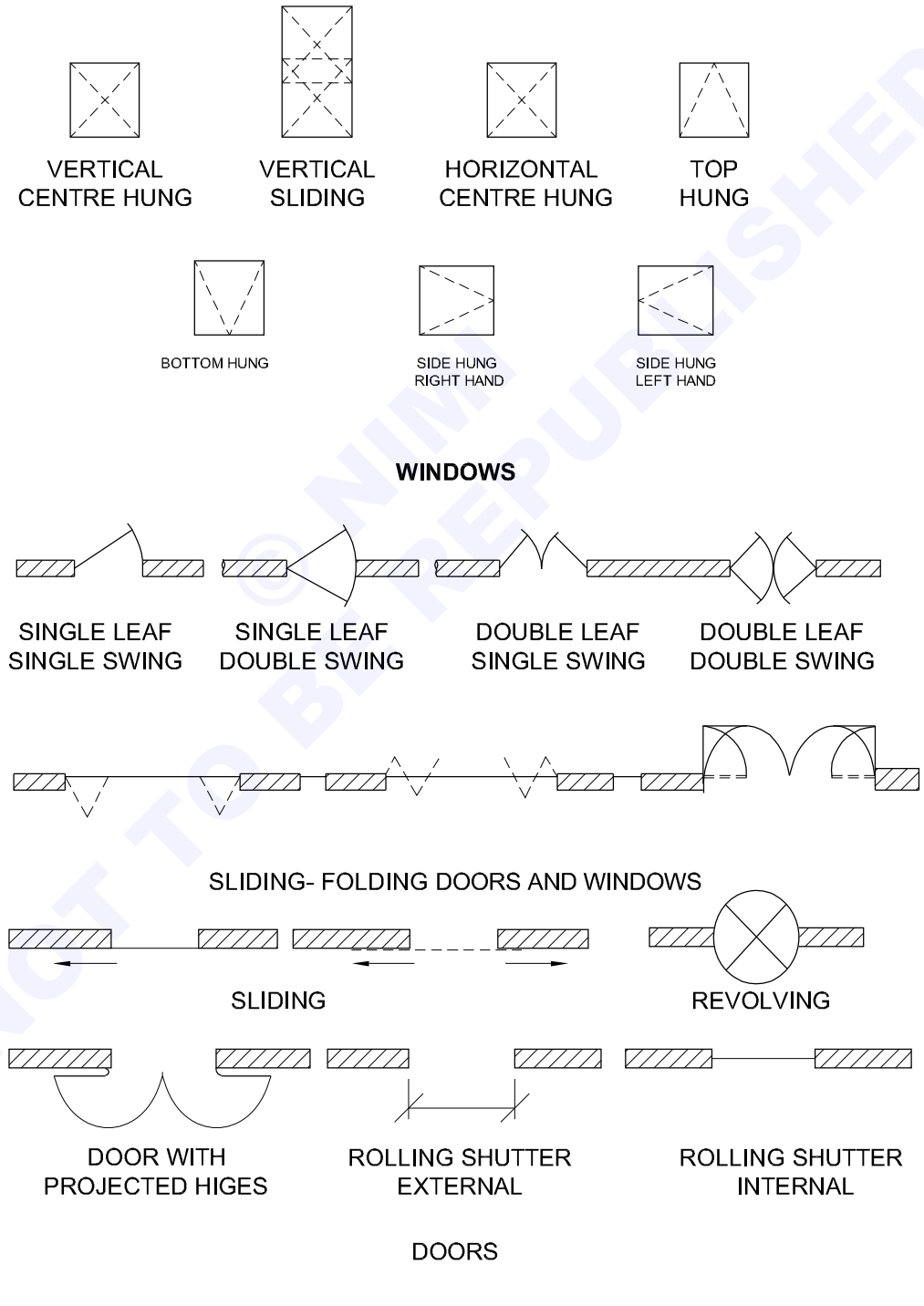
TASK 1: **Draw the symbols for various doors and windows (Fig 1)**

1 Layout on drawing area for showing signs and symbols of doors and windows.

2 Illustrate signs and symbols of different types of doors and windows.

3 Name the illustration drawn.

Fig 1



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CE20N1214H1

Symbols for sanitary installations and fitment

Objectives: At the end of this exercise you shall be able to
- **identify the signs and symbols of various sanitary installations and fitment**
- **illustrate the signs and symbols of various sanitary installations and fitment**
- **use appropriate signs and symbols for showing sanitary installations and fitment used in drawing.**

TASK 1: **Draw the symbols for various civil engineering symbols**

1 Layout on drawing area for showing signs and symbols of sanitary installations and fitment.

2 Illustrate signs and symbols of different types of sanitary installations and fitment.

3 Name the illustration drawn.

NAME	SYMBOL	NAME	SYMBOL
BATH		SHOWER TRAY	
BIDET		WASH BASIN	

SYMBOLS FOR SANITARY INSTALLATIONS-CONTD

NAME	SYMBOL	NAME	SYMBOL
CORNER LAVATORY BASIN	LB	CLEANER'S SINK	
TROUGH LAVATORY, WALL TYPE	TL	LAUNDRY SINK	
TROUGH LAVATORY, ISLAND TYPE	TL	WC	
CIROULAR WASHING FOUNTAIN		URINAL BOWL	
SINGLE SINK, LEFT HAND DRAINER		URINALSTALLS	
DOUBLE SINK, LEFT HAND DRAINER		INDUSTRIAL WASHING TROUGH	
SINGLE SINK, WITH DOUBLE DRAIN BOARD		PEDESTAL DRINKING FOUNTAIN	DF
DOUBLE SINK, WITH DOUBLE DRAIN BOARD		DRINKING FOUNTAIN, WALL TYPE	DF
		FLOOR TRAP	FT

SYMBOLS FOR SANITARY INSTALLATIONS

NAME	SYMBOL	NAME	SYMBOL
MANHOLE OR INSPECTION CHAMBER	MH OR IC	STAIR	UP
COLD WATER CISTERN	C W C	COOKER	C
INTERCEPTING TRAP AND FRESH AIR INLET	MH NO, F A I	REFRIGERATOR	R
VENT INLET		WASH BOILER, 'G'GAS, 'B' ELECTRIC	W B C
VENT OUTLET		WASHING MACHINE, WRINGE TYPE	WM
RAIN-WATER OUTLET	R W O	WASHING MACHINE, AUTOMATIC	AW
RADIATOR		CENTRIFUGAL DRYER	D
UNIT HEATER		CABINET DRYER	D
CONVECTOR		RACK DRYER	D
SURFACE PANEL, WALL TYPE		LAUNDRY TRAY, SINGLE	LT
SURFACE PANEL, WALL TYPE		LAUNDRY TRAY, DOUBLE	L T
EMBEDDED PANEL IN CAST-IN CEILING		IRONING MACHINE	I M
EMBEDDED PANEL IN SUSPENDED CEILING		BUILT-IN IRONING BOARD	
EMBEDDED PANEL IN CAST-IN FLOOR		SURFACING IRONING BOARD	
UNIT HEATER		BED	
TOWEL RAIL			

FITMENT SYMBOLS

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Symbols for surveying

Objectives: At the end of this exercise you shall be able to
- **identify the signs and symbols used in surveying**
- **illustrate the signs and symbols used in surveying**
- **use appropriate signs and symbols for surveying work.**

TASK 1: **Draw the symbols used for surveying**

1 Layout on drawing area for showing signs and symbols for surveying.

2 Illustrate signs and symbols used for surveying.

3 Name the illustration drawn.

SL. NO.	OBJECT	CONVENTIONAL SIGN	COLOUR
1.	CHAIN LINE		CRIMSON LAKE
2.	TRIANGULATION STATION	A	CRIMSON LAKE
3.	TRAVERSE STATION	A	CRIMSON LAKE
4.	BENCH MARK	OR B.M. 10.000	CRIMSON LAKE
5.	BUILDING (PUCCA)		CRIMSON LAKE
6.	BUILDING (KATCHA)		BURNT UMBER
7.	TEMPLE, CHURCH, MOSQUE		CRIMSON LAKE
8.	WALL & GATE		CRIMSON LAKE
9.	BOUNDARY WITH PILLARS		CRIMSON LAKE
10.	DAM		CRIMSON LAKE
11.	CITY OR TOWN		BUILDINGS - CRIMSON LAKE ROADS - BURNT SIENNA
12.	CEMETRY		BLACK
13.	RIVER		PRUSSIAN BLUE
14.	CANAL OR STREAM (PERENNIAL)		PRUSSIAN BLUE
15.	CANAL OR STREAM (NON-PERENNIAL)		EDGES - BLACK
16.	CANAL WITH LOCK		PRUSSIAN BLUE
17.	LAKE OR POND		PRUSSIAN BLUE
18.	WELL		PRUSSIAN BLUE
19.	DRAIN (KATCHA)		PRUSSIAN BLUE
20.	DRAIN (PUCCA)		DRAIN - PRUSSIAN BLUE DIRECTION - CRIMSON LAKE
21.	WIRE FENCING		BLACK
22.	WOOD FENCING		YELLOW
23.	PIPE RAILING		BLACK
24.	BOUNDARIES		BLACK
25.	HEDGE		HEDGE GREEN
26.	TREE	OR	HEDGE GREEN

SL. NO.	OBJECT	CONVENTIONAL SIGN	COLOUR
27.	JUNGLE		HEDGE GREEN
28.	ORCHARD		HEDGE GREEN
29.	CULTIVATED LAND		DRAINS - PRUSSIAN BLUE CULTIVATION - GREEN
30.	BARREN LAND		BLACK
31.	ROUGH PASTURE		BLACK
32.	MARSH OR SWAMP		BLACK
33.	SAND HILL		BLACK
34.	EMBANKMENT		BLACK
35.	CUTTING		BLACK
36.	FOOTH-PATH		BURNT UMBER
37.	VILLAGE CART-TRACK		BURNT UMBER
38.	UNMETALLED ROAD		BURNT SIENNA
39.	METALLED ROAD		BURNT SIENNA
40.	RAILWAY SINGLE LINE	OR	BLACK
41.	RAILWAY DOUBLE LINE		BLACK
42.	ROAD BRIDGE		BURNT SIENNA
43.	RAILWAY BRIDGE		BLACK
44.	ROAD & RAIL LEVEL CROSSING		RAIL - BLACK ROAD - BURNT SIENNA
45.	TELEPHONE OR TELEGRAPH LINE		BLACK
46.	ELECTRIC LINE		BLACK
47.	NORTH DIRECTION	N	BLACK
48.	DEMARCATED PROPERTY BOUNDARY		
49.	UNDEMARCATED PROPERTY BOUNDARY		
50.	CULVERT		
51.	ELECTRIC LINE		

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Electrical symbols

Objectives: At the end of this exercise you shall be able to
- **identify the electrical signs and symbols**
- **illustrate various electrical signs and symbols.**

TASK 1: **Draw the symbols used for electrical**

1 Draw the electrical symbols shown.

2 Illustrate signs and symbols used in electrical

3 Name the illustration drawn.

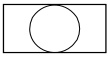
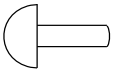
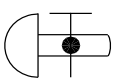
NAME	SYMBOL	NAME	SYMBOL
RELAY (AT 'N', INSERT THE NUMBER OF WAYS)		AERIAL	
SYNCHRONOUS CLOCK OUTLET		CEILING FAN	
IMPULSE CLOCK OUTLET		BRACKET FAN	
MASTER CLOCK		EXHAUST FAN	
FIRE ALARM PUSH		FAN REGULATOR	
AUTOMATIC CONTACT		COOKER CONTROL UNIT	
BELL CONNECTED TO FIRE ALARM		EARTH POINT	
FIRE ALARM INDICATOR (AT 'N' INSERT NUMBER OF WAYS)		SURGE DIVERTER	
AMPLIFIER		PILOT OR CORRIDOR LAMP	
CONTROL BOARD		INDICATOR (BUZZER MAY BE ADDED, IF REQUIRED)	N
MICROPHONE OUTLET		RELAY	
LOUDSPEAKER OUTLET		RESET POSITION	
RECEIVER OUTLET		HORN OR HOOTER	
		SIREN	

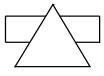
THIS GENERAL SYMBOL IS APPLICABLETO ANY SYSTEM BY THE ADDITION OFAN IDENTIFYING SYMBOL (APPROPRIATE TO A PARTICULAR SYSTEM) IN THE UPPER HALF.FOR EXAMPLE,BELL SYSTEM RELAY.

WHERE ITEMS OF OPERATIONS ARE COMBINED, THE SYMBOLS MAY BE COMBINED, FOR EXAMPLE,INDICATOR AND BELL.

NAME	SYMBOL	NAME	SYMBOL
MAIN FUSE- BOARD WITHOUT SWITCHES,LIGHTING		COUNTER WEIGHT PENDANT	C W
MAIN FUSE-BOARD WITH SWITCHES,LIGHTING		ROD PENDANT	R
MAIN FUSE- BOARD WITHOUT SWITCHES,POWER		CHAIN PENDANT	C
MAIN FUSE-BOARD WITH SWITCHES,POWER		LIGHT BRACKET	
LIGHT PLUGS		BATTEN LAMPHOLDER	BH
POWER PLUG		WATER-LIGHT LIGHT FITTING	W T
DISTRIBUTION FUSE-BOARD WITH OUT SWITCHES, LIGHTING		BULK-HEAD FITTING	
DISTRIBUTION FUSE-BOARD WITH SWITCHES, LIGHTING		POWER FACTOR CAPACITOR (WHEN INSTALLED REMOTE FROM THE LAMP UNIT)	
DISTRIBUTION FUSE-BOARD WITHOUT SWITCHES, POWER		FLUORESCENT LIGHT (SIGLE)	
DISTRIBUTION FUSE-BOARD WITH SWITCHES, POWER		FLUORESCENT LIGHT (DOUBLE)	
MAIN SWITCHES, LIGHTING		LIGHTING OUTLET CONNECTION TO AN EMERGENCY SYSTEM	
MAIN SWITCHES,POWER	P	CHOKE (WHEN INSTALLED REMOVE FROM THE LAMP UNIT)	
METER		ONE-WAY SWITCH	
SINGLE LIGHT PENDANT		TWO-WAY SWITCH	
PENDANT SWITCH	P	INTERMEDIATE SWITCH	
		PULL SWITCH	

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NAME	SYMBOL
SOCKET-OUTLET,2 PIN 5 AMP	
SOCKET-OUTLET,3 PIN 5 AMP	
SOCKET-OUTLET AND SWITCHCOMBINED, 2 PIN 5 AMP	
SOCKET-OUTLET AND SWITCH COMBINED, 3 PIN 5 AMP	
SOCKET-OUTLET,2 PIN 15 AMP	
SOCKET-OUTLET,3 PIN 15 AMP	
SOCKET-OUTLET AND SWITCH COMBINED, 2 PIN 15 AMP	
SOCKET-OUTLET AND SWITCH COMBINED, 3 PIN 15 AMP	
CONVECTION HEATER	
ELECTRIC UNIT HEATER	
IMMERSION HEATER	
THERMOSTAT	
IMMERSION HEATER WITH INCORPORATED THERMOSTAT	

NAME	SYMBOL
SELF-CONTAINED ELECTRIC WATER HEATER	
HUMIDISTAT	
BELL PUSH	
BELL	
BUZZER	
INDICATOR (AT 'N' INSCRT NUMBER OF WAYS)	
TELEPHONE INSTRUMENT POINT PUBLIC SERVICE	
TELEPHONE INSTRUMENT POINT INTERNAL	
TELEPHONE CABLE DISTRIBUTION BOARD PUBLIC SERVICE	
TELEPHONE CABLE DISTRIBUTION BOARD INTERNAL	
TELEPHONE PRIVATE EXCHANGE PUBLIC SERVICE	
TELEPHONE PRIVATE EXCHANGE OR INTERNAL	

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Draw types of Lines, lettering and numbering as and dimensioning techniques per IS 962- 1989, SP- 46:2003

Objectives: At the end of this exercise you shall be able to
- **select and calculate the size of letters**
- **draw the layout for printing letters and numerals, as height and width of letter**
- **print single stroke letters and numerals**
- **print double stroke letters and numerals.**

PROCEDURE

TASK 1: **Lettering practice**

1 Select the size of letters and calculate the height & width of each letter.

2 Arrange and draw the guidelines for the required size.

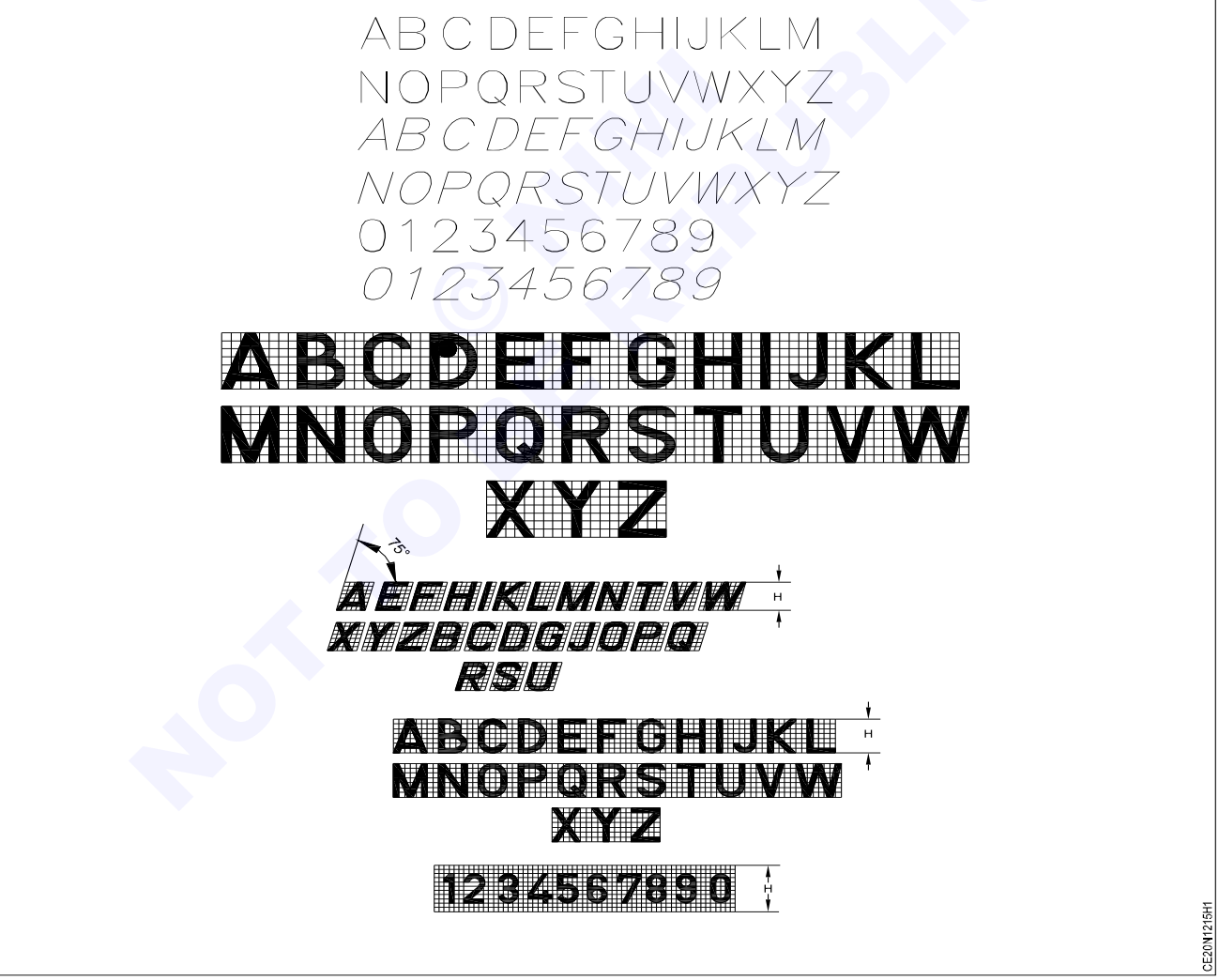
3 Prepare the layout for printing of letters

4 Mark the width and spacing for each letters

5 Draw vertical guide lines (Fig 1)

6 Print the letter by freehand, using H or HB pencil.

Flg 1



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To draw convention of lines

Objectives: At the end of this exercise you shall be able to
- **sketch and describe the illustration of the types of conventional lines**
- **apply illustrations of lines in the drawing.**

TASK 1: **Draw the convention of lines**

1 Draw the table as shown in the figure.

2 Write the descriptions and draw the illustration in the table.

Line	Description	General applications see figure and other relevant figure
A	Continuous thick	A1 Visible outlines A2 Visible edges
B	Continuous thin (straight or curved)	B1 Imaginary lines of intersection B2 Dimension lines B3 Projection lines or extension line B4 Leader lines B5 Hatching B6 Outline of revolved sections in place B7 Short centre lines B8 Thread lines B9 Diagonal line
C	Continuous thin free hand	C1 Limits of partial or interrupted views & sections, if the limit is not a chain thin
D 	Continuous thin (straight) with zig-zags	D1 Line (see figure)
E	Dashed thick	E1 Hidden outlines E2 Hidden edges
F	Dashed thin	F1 Hidden outlines F2 Hidden edges
G	Chain thin	G1 Centre lines G2 Lines of symmetry G3 Trajectors
H	Chin thin, thick at ends & changes of direction	H1 Cutting planes
J	Chain thick	J1 Indication of lines or surfaces to which a special requirement applies
K	Chain thin double dashed	K1 Outlines of adjacent parts K2 Alternative and extreme positions of movable parts K3 Centroidal lines K4 Initial outlines prior to forming K5 Parts situated in front of the cutting plane.

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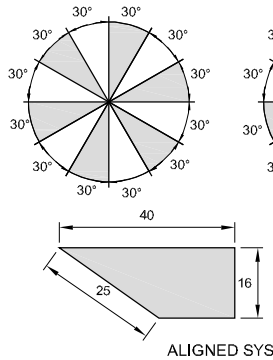
Dimensioning techniques

Objectives: At the end of this exercise you shall be able to
- **draw different systems of dimensioning**
- **dimension the drawings by aligned system and unidirectional system**
- **follow the standard of system of dimensioning with different arrangements of dimensional values.**

TASK 1: **To show aligned system of dimensioning**

1 Draw the figures as shown (Fig 1).

Fig 1



ALIGNED SYSTEM

CE20N1215J1

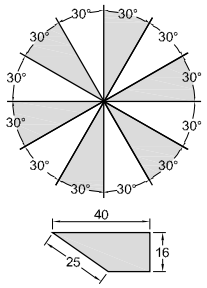
2 Show the dimension lines in the figures.

3 Place the dimension value above the dimension line centrally as shown.

To show unidirectional system of dimensioning

1 Draw the figures as shown (Fig 2).

Fig 2



UNIDIRECTIONAL SYSTEM

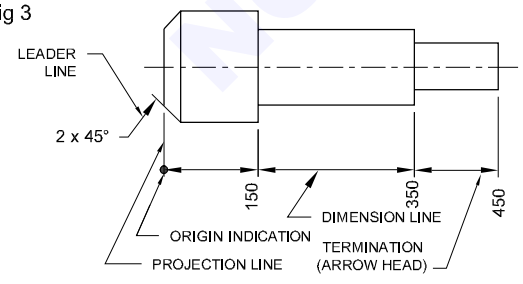
CE20N1215J2

2 Show the dimension lines in the figures.

3 Cut the dimension line at center to place the dimension value horizontally.

To show various notations used in dimensioning (Fig 3 - 9)

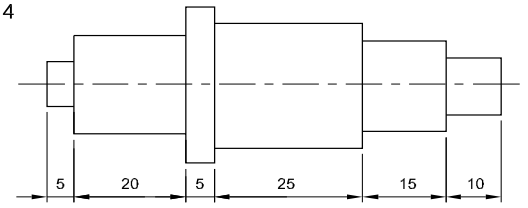
Fig 3



ELEMENTS OF DIMENSIONING

CE20N1215J3

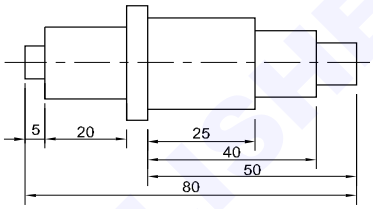
Fig 4



CHAIN DIMENSION

CE20N1215J4

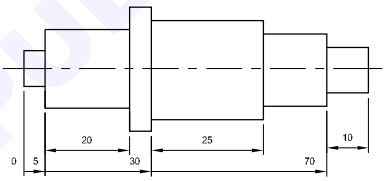
Fig 5



COMBINED DIMENSIONING (CHAIN AND PARALLEL)

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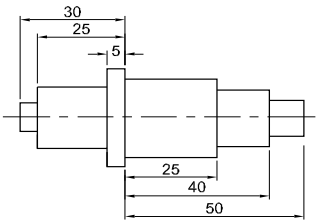
Fig 6



COMBINED DIMENSIONING (CHAIN AND SUPERIMPOSED RUNNING)

CE20N1215J6

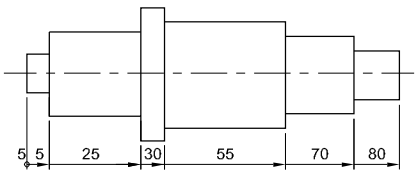
Fig 7



PARALLEL DIMENSIONING

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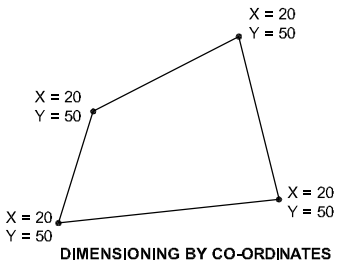
Fig 8



SUPERIMPOSING RUNNING DIMENSIONING IN ONE DIRECTION

CE20N1215J8

Fig 9



DIMENSIONING BY CO-ORDINATES

CE20N1215J9

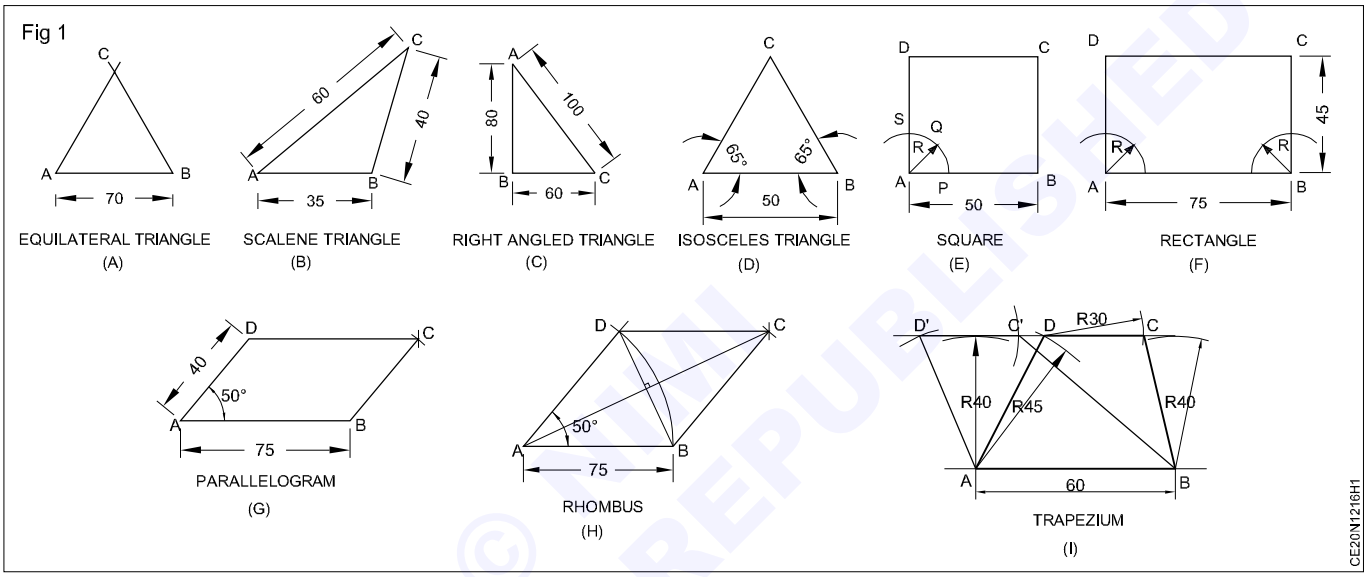
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Construction of plain geometrical figures

Objectives: At the end of this exercise you shall be able to
- **construct an equilateral triangle**
- **construct a scalene triangle**
- **construct a right angled triangle**
- **construct an isosceles triangle**
- **construct various quadrilaterals.**

PROCEDURE

TASK 1: **Construct an equilateral triangle (Fig 1A)**



1 Draw a horizontal line AB of length 70mm.

2 From A, draw an arc as radius of length of line AB

3 Similarly, from B draw an arc as radius of length of line AB to intersect the first arc.

4 Name the intersect point as C.

5 Join AC and BC points with a line to form a triangle.

6 Constructed triangle is an equilateral triangle.

— — — — — — — —

TASK 2: **To Construct a scalene triangle (Fig 1B)**

Length of all three sides are given, AB =35mm, AC=60mm&BC =40mm

1 Draw base line AB=35 mm

2 'A' as centre draw an arc of radius 60 mm

3 'B' as centre draw an arc of 40 mm, cutting the previous arc at 'C'.

4 Join CA & CB. ABC is the required scalene triangle

— — — — — — — —

TASK 3: **To Construct a right angled triangle (Fig 1C)**

AB = 80mm, BC = 60mm

1 Draw the horizontal line BC to length 60mm.

2 Erect a perpendicular to length 80mm at B.

3 Join AC

4 ABC is the required right angled triangle

— — — — — — — —

TASK 4: **To Construct an isosceles triangle (Fig 1D)**

AB = 50mm and ∠CAB= ∠ABC= 65°

1 Draw line AB = 50mm

2 Set an angle 65°at A and B

3 Extent the line meeting at C. ABC is the required isosceles triangle.

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TASK 5: **To construct quadrilaterals**

Construct a square (Fig 1E)

A square of side 50mm by erecting perpendicular.

1 Draw a line AB 50mm long

2 A as centre, draw an arc of convenient radius 'r' touching the line AB as shown in figure.

3 'P' as centre and radius 'r' draw another arc cutting the earlier drawn arc at 'Q'

4 'Q' as centre and radius 'r', draw another arc cutting at 'R'.

5 Bisect QR at S and extend.

6 Mark 50mm on AS extended line. AD = 50mm.

7 From points B and D, draw parallels to AD and AB and complete the square ABCD.

— — — — — — — —

TASK 6: **Constructing rectangle (Fig 1F)**

1 Sides 75mm and 45mm

2 Draw a line AB 75mm long.

3 From A and B, erect perpendicular .

4 Mark C and D as AD=BC=45mm

5 Join CD and complete the rectangle.

— — — — — — — —

TASK 7: **Constructing parallelogram (Fig 1G)**

1 Sides = 75mm and 40mm , Angle between them: 50° - Draw a line AB 75mm long.

2 Draw line AD equal to 40 mm and make one angle of 50° to AB.

3 D as centre draw an arc of radius equal to AB.

4 B as centre draw an arc of radius equal at AD, upwards such that they meet at a point 'C'.

5 Join BC and DC. ABCD is the required Parallelogram.

— — — — — — —

TASK 8: **Constructing rhombus (Fig 1H)**

1 Draw two adjacent lines AB and AD equal to 75mm at 50^0 angle

2 B and D as centres draw R75 arcs intersecting at C.

3 Join DC and BC, ABCD is the required rhombus.

— — — — — — —

TASK 9 : **Constructing Trapezium (Fig 1I)**

Parallel sides AB = 60mm, CD = 30mm, Distance between parallel sides = 40mm, Side DA = 45mm.

1 Draw the base AB equal to 60mm.

2 With radius 40mm, draw arcs from A and B.

3 Draw a tangential line (parallel to AB)

4 Draw an arc with radius 45mm and A as centre, cutting the line at two places D and D'

5 From D or D' mark length of 30mm towards right side, mark it as C or C'.

6 Join B and C or C'.

7 Join A and D or D'.ABCD/ABC'D' is the Trapezium

Try to construct all these figures with different methods as you can

— — — — — — — —

To construct polygons

Objective : At the end of this exercise you shall be able to
• **construct a regular polygon from the given data.**

TASK 1 : **Regular heptagon of side 30 mm**

Semi-circular method - Type A (Fig 1)

1 Draw a line AB equal to 30 mm.

2 Extend BA to a convenient length.

3 A as centre and radius AB describe a semi-circle.

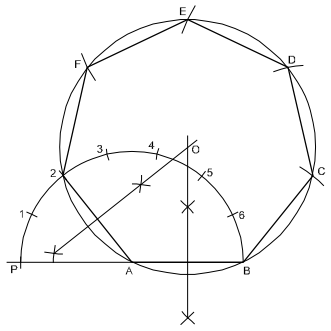
4 Divide the semi-circle into seven equal parts (number of sides) using divider.

5 Number the points as 1,2,3,4,5,6 starting from P.

6 Draw the perpendicular bisectors from 2A and AB intersecting at 0.

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Fig 1



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7 0 as centre and OA or OB as radius describe a circle.

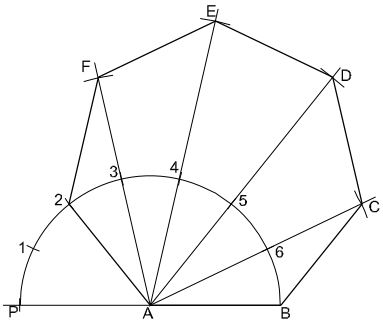
8 Mark the points C,D,E,F and 2 on the circle such that BC = CD = DE = EF = F2 = AB = 2A.

9 Join the line BC, CD, DE, EF and F2.

10 ABCDEF2 is required heptagon.

Semi-circle method - Type B (Fig 2)

Fig 2



CE20N1216J2

Follow the procedure of Type A upto dividing the semicircle into number of equal parts.

1 Join A2

2 Join A3, A4, A5 and A6 and extend to a convenient length.

3 With centre B and radius AB draw an arc cutting A6 extended line at C.

4 C as centre and same radius, draw an arc cutting the line A5 at D.

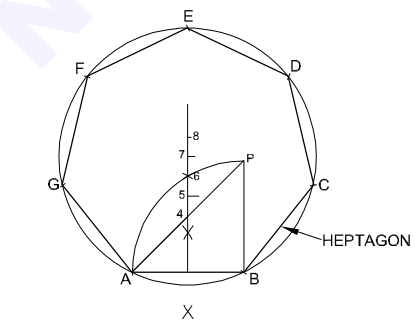
5 Locate the points E & F in the same manner.

6 Join BC, CD, DE, EF and F2.

7 ABCDEF2 is the required heptagon.

Perpendicular bisector method - Type A (Fig 3)

Fig 3



CE20N1216J3

1 Draw a line AB equal to 30 mm.

2 At B, draw a line BP perpendicular AB and equal to AB.

3 Join AP

4 B as centre BA as radius, draw an arc AP.

5 Bisect AB and draw the bisector cutting the line AP and the arc AP at 4 & 6 respectively.

6 Mark 5 the mid point of 4-6.

7 Set off 6-7, 7-8, 8-9, 9-10 equals to 4-5.

8 7 as centre, 7A as radius, draw a circle on AB.

9 On the circumference set off BC, CD, DE, EF, FG equals to AB.

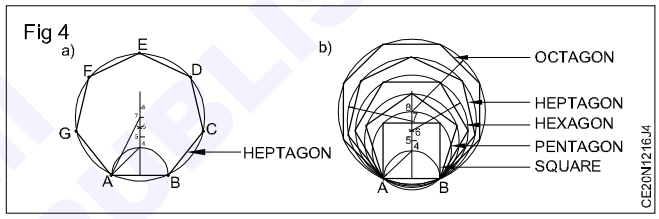
10 Join BC, CD, DE, EF, FG and GA.

11 ABCDEFG is the required heptagon.

12 Mark point 5 at the mid-point of 4 and 6.(Fig 4a) and complete the heptagon.

In this method also any regular polygon of different sides can be constructed.(Fig 4b)

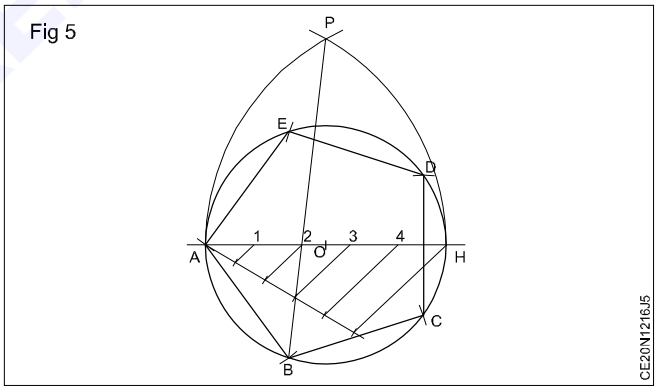
Fig 4



CE20N1216J4

Pentagon inside a circle of diameter 80 mm (Fig 5)

Fig 5



CE20N1216J5

1 Draw the line AH equals to 80 mm. (Diameter of circle)

2 `O' as centre OA as radius describe a circle.

3 Divide AH into 5 equal parts (as many equal parts as the sides).

4 A and H as centres, AH as radius describe arcs intersecting at P.

5 Join P2 and extend it to meet the circle at B.

6 Set off BC, CD, DE, EF equals to AB on the circle.

7 Join the points

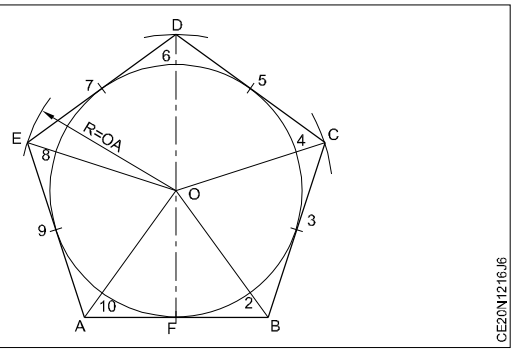
8 ABCDEF is the required pentagon.

Pentagon outside a circle of diameter 80 mm (Fig 6)

1 O as centre and OF as radius describe a circle of dia 80 mm.

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Fig 6



2 Draw the line DF vertically beyond the top of the circle.

3 Divide the circle into 10 equal parts. (Twice as many equal parts as the number of sides)

4 Points 1,3,5,7 and 9 are the tangent points of the pentagon.

5 Join 02, 04, 06, 08, 010 and extend to a convenient length.

6 Draw a tangent to the circle through point 1 (F).

7 The tangent cuts the lines 0-2 and 0-10 lines at A & B.

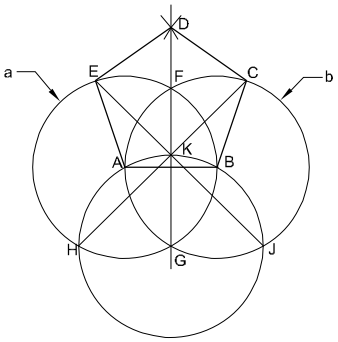
8 Draw tangents on points 3,5,7,9 & locate C,D & E in the same manner.

9 Join BC, CD, DE, EA

10 ABCDE is the required pentagon.

Three circle method (Fig 7)

Fig 7



Pentagon of 38 mm side

1 Draw the line AB equal to side of polygon 38 mm.

2 Draw two circles of radius equal and AB, with center A and B, cutting at two points F and G.

3 Join G and F extend upwards.

4 AB as radius, G as centre, draw a circle passing through A and B cutting both the circles at H and J, and also cutting the line FG at K.

5 Join HK and extend to cut the circle (b) at C.

6 Join JK and extend to cut circle (a) at E.

7 Join AE and BC.

8 E and C as centers, AB as radius, draw arcs to cut at D.

9 Join ED and CD. ABCDE is the regular pentagon.

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Construction of scales - plain, comparative , diagonal , vernier scale and scale of chords

Objectives: At the end of this exercise you shall be able to
- **find out R.F of the scale and calculate the length of scale on drawing**
- **construction of plain scales, comparative scales, diagonal scale and vernier scales**
- **mark the distance on the scale and construct a scale of chords.**

PROCEDURE

TASK 1: **Construct a plain sale of 1:60 to show metres and decimeters and long enough to measure up to 6 meters. Find and mark on it a distance of 3.7 metres**

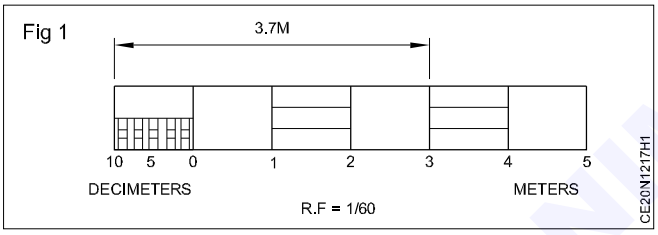
1 R.F=Drawing size/Actual size=1cm/60cm=1/60

2 Length of scale=R.F. x maximum length to be measured.

3 length of scale=1/60x6m=1/10metre=10cm

4 Draw a horizontal line of length 10cm (Fig 1).

Fig 1



5 Draw a rectangle of size 10cmx0.5 cm.

6 Divide the rectangle into 6 equal divisions, each division representing 1m.

7 Mark 0 (zero) at the end of the first main divisions and 1,2,3,4 and 5 at the end of each subsequent division to its right,

8 Divide the first main division into 10 equal sub-divisions, each representing 1dm.

Solve the problem by yourself

1 Construct a plain scale of RF $\frac{1}{20}$ to measure upto 10cm (min) and mark a distance of 1.2 metres on the scale.

2 Construct a plain scale of RF $\frac{1}{40}$ to measure metres and decimetres and mark a distance of 3.7m.

3 Draw the lines for sub-divisions slightly shorter as shown.

4 Draw thick and dark horizontal lines in the middle of all alternate divisions and sub-divisions. This will help in taking measurements.

5 Below the scale, print METRES on the right hand side, DECIMETRES on the left-hand side, and R.F in the middle.

6 Indicate on the scale a distance of 3.7 metres = 3 main divisions to the right side of 0(zero)+7 sub divisions to the left of 0(zero).

— — — — — — — —

TASK 2: **Construct a comparative scale to convert Fahrenheit (°F) into Celsius °C and vice-versa (Fig 1)**

1 Draw a line AB of 15 cm long. (Top part will read °C and bottom part will read °F)

2 Divide the line into 10 equal divisions.

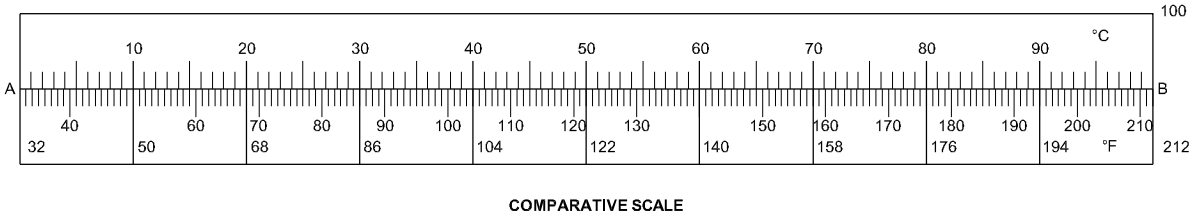
3 Top side mark 0,10,20....100 for °C scale (100 divisions) and on bottom side, mark 32, 50, 68.... 212 for °F scale 180 divisions as shown.

4 On °C side divide one division into 10 equal parts. (Now each small division represents 1°C)

5 On °F side, divide each division into 18 equal parts. (Now each small division represents 1°F)

6 Mark other numbers and complete drawing the scale.

Fig 1



— — — — — — — —

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TASK 3 : **Construct a diagonal scale for 4 m length and show the lengths 2.69 m, 1.09 m and 0.08 m. (RF = 1/25) (Fig 1)**

Length of scale required = RF x length to be measured

$= \frac{1}{25}$ x 4 m x 100 = 16 cm.

1 Draw a rectangle ABCD of 16 cm x 4 cm.

2 Divide the rectangle ABCD into 4 equal parts and mark them EF, GH & IJ and each division represents one metre.

3 Divide the line AB into ten equal parts and mark them 1_1, 2_1, 3_1.....10_1.

4 Draw Horizontal lines from points 1, 2..... etc.

5 Divide the BF into 10 equal parts and mark them as 1'2'3' etc and each division representing 10 cm (1 dm).

6 Draw diagonals on all ten small rectangles in the 1st (lower) block ABFE and complete the diagonal scale.

7 Metres are read on EF or line parallel to it i.e GH, IJ & DC. Decimetres are read on the division of line AE and centimetres are read on points where the diagonals intersect with the vertical parallel lines drawn through the divisions of line AB.

8 Mark 2.69 using the diagonal scale. (Fig 1)

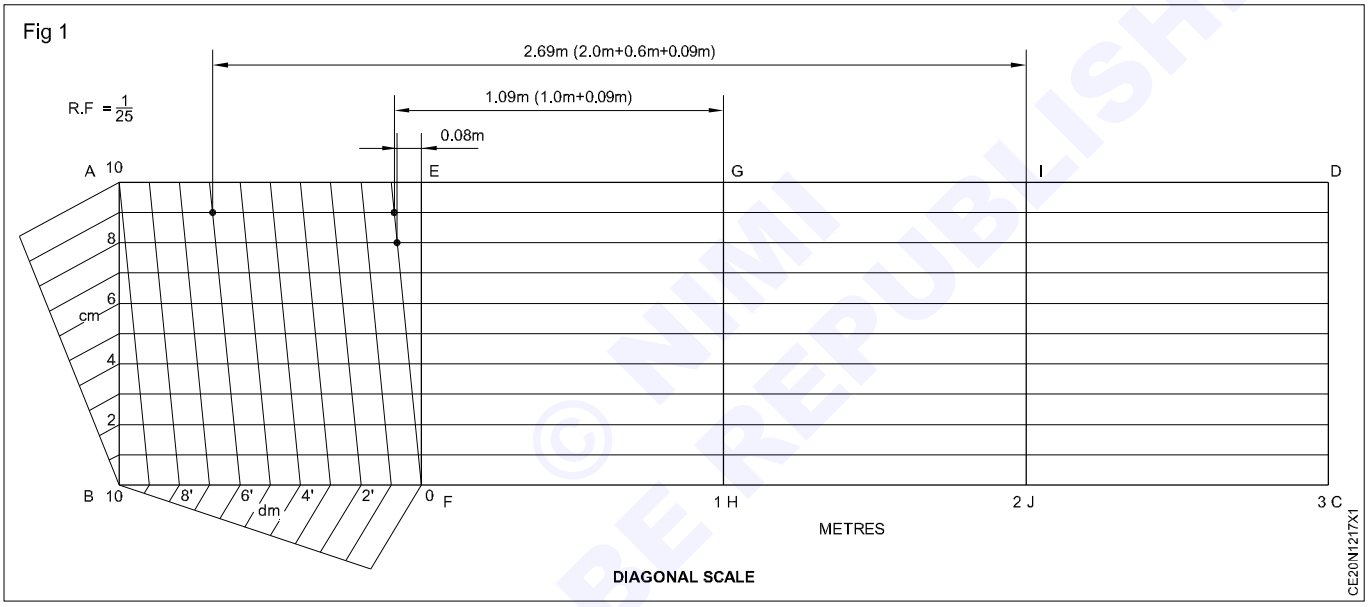
2.00 m on metre division

0.60 m on decimetre division

0.09m in the diagonal cm division

1.09 m and 0.08 m are also marked in the fig 1 in the same way.

Fig 1



TASK 4: **Construct a direct vernier scale of RF = $\frac{1}{25}$ to read centimetres for 4 m, 3.72 m and 2.74 m (Fig 1)**

Length of scale = $\frac{1}{25}$ x 4m x 100 = 16 cm.

1 Draw a rectangle ABCD (16 cm x 1 cm) representing main scale.

2 Divide the main scale into 4 length of each part equal and representing 1 metre.

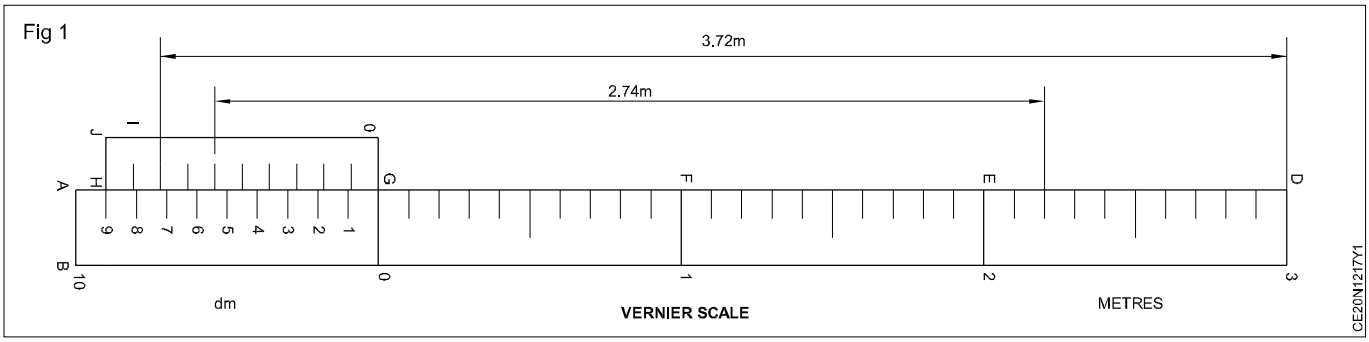
Divide each line AG, GF, FE & ED into 10 equal divisions and each division is called one main scale division. (1 dm)

3 Add another rectangle GO, J, H as secondary scale (vernier) to a length of 9 MSD (9 dm).

4 Divide GH into 10 equal division on secondary (vernier scale) side and complete the vernier scale.

Lowest main scale block and vernier side portion of Fig 1 is shown with more detail in Fig 1 TASK 5.

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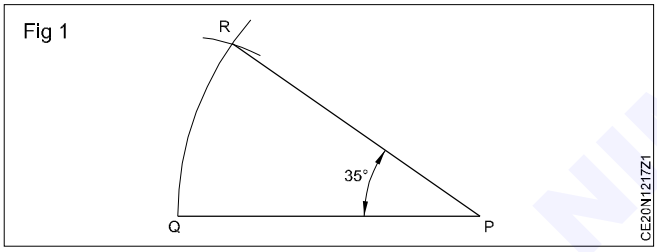
TASK5: **construct of scale of chord and draw an angle 35° (Fig 1 & 2)**

1 Draw a quadrant ABC and extend the line AB.

2 'A' as centre AC as radius, draw the arc CD. (Now AB represents the chord of arc CD)

3 Divide the arc AC into 18 equal parts, so that each division will represents 5°.

4 'A' as centre, draw arcs with radii A_1', A_2'.... A_{18}' to intersect line DA and mark them 5°, 10°.... 90° as shown in Fig 2.



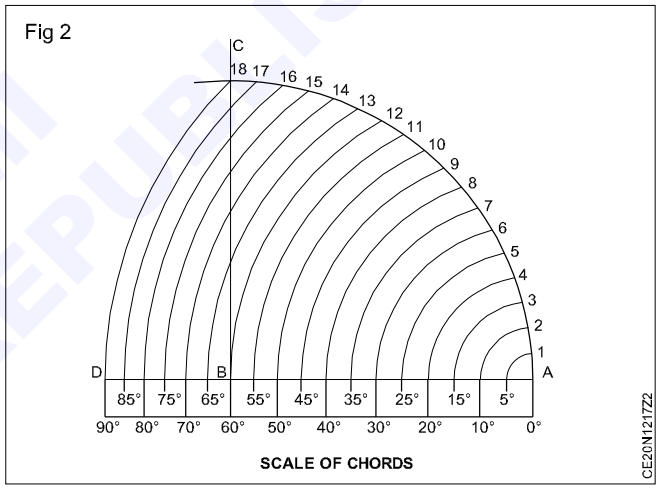
To draw the angle of 35°

1 Draw a line PQ equal to AB.

2 'P' as centre PQ as radius, draw arc.

3 Set the compass to A-35° and 'Q' as centre, draw an arc to intersect the previous arc at R.

4 Join PR by a straight line and now angle RPQ = 35°.



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Drawing of Construction of solid geometrical figures

Objective: At the end of this exercise you shall be able to
- **draw the following geometrical solid figures.**

PROCEDURE

TASK 1: **Draw the following given solid geometrical figures in its position (Fig 1 - 8)**

Fig 1

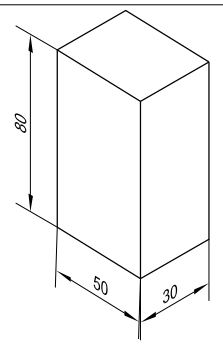


Fig 2

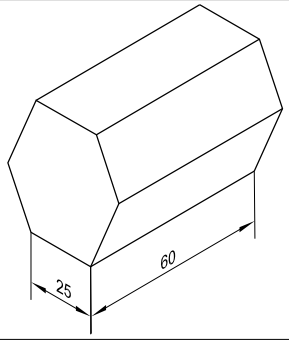


Fig 3

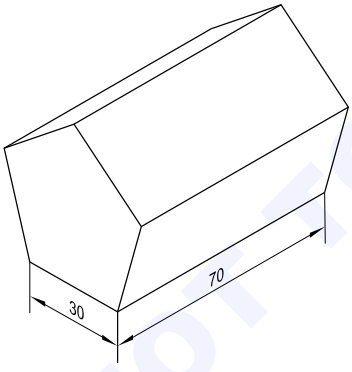


Fig 4

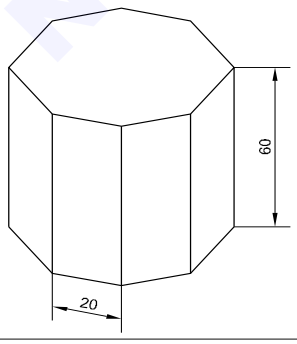


Fig 5

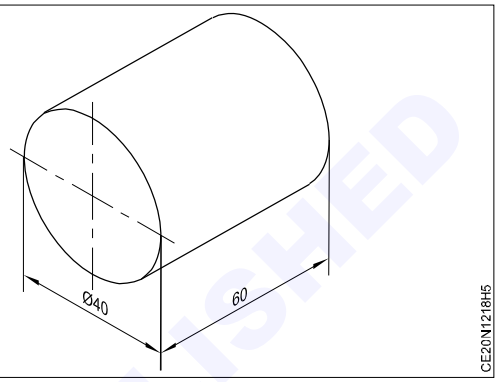


Fig 6

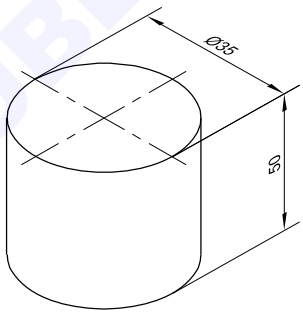


Fig 7

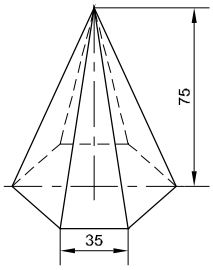
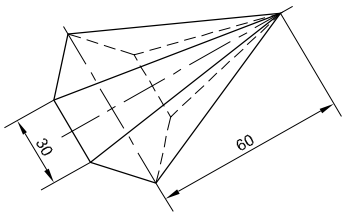


Fig 8



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Three views in orthographic - projection of line, plane, solid object and section of solids

Objectives: At the end of this exercise you shall be able to
- **draw first angle projection method**
- **draw third angle projection method.**

PROCEDURE

TASK 1: **First angle projection**

1 Draw the views with reference to the front directions indicated.

2 The view from top is placed underneath

3 The view from bottom is placed above

4 The view from the left is placed on the right

5 The view from the right is placed on the left

6 The view from the rear may be placed on the left or on the right as may be found convenient.

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TASK 2: **Third angle projection (Fig 1)**

1 Draw the views with reference to the front directions indicated.

2 The view from top is placed above

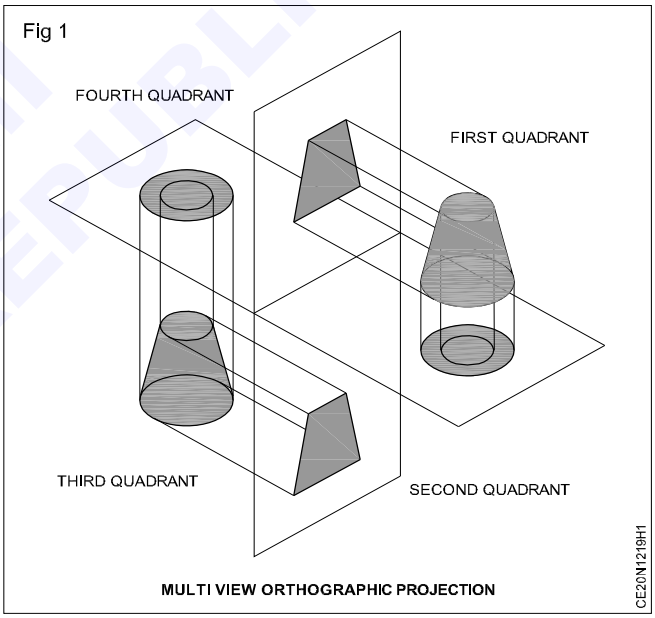
3 The view from bottom is placed underneath

4 The view from the left is placed on the left

5 The view from the right is placed on the right

6 The view from the rear may be placed on the left or on the right as may be found convenient.

Fig 1



— — — — — — — —

TASK 3: **Draw the plan, elevation and side views in first angle projection (Fig 1 (a)).**

— — — — — — — —

TASK 4: **Draw the plan, elevation side views in 3rd angle projection (Fig 1 (b))**

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TASK 5: **Draw the combination of first angle and third angle projection of the object (Fig 1(c))**

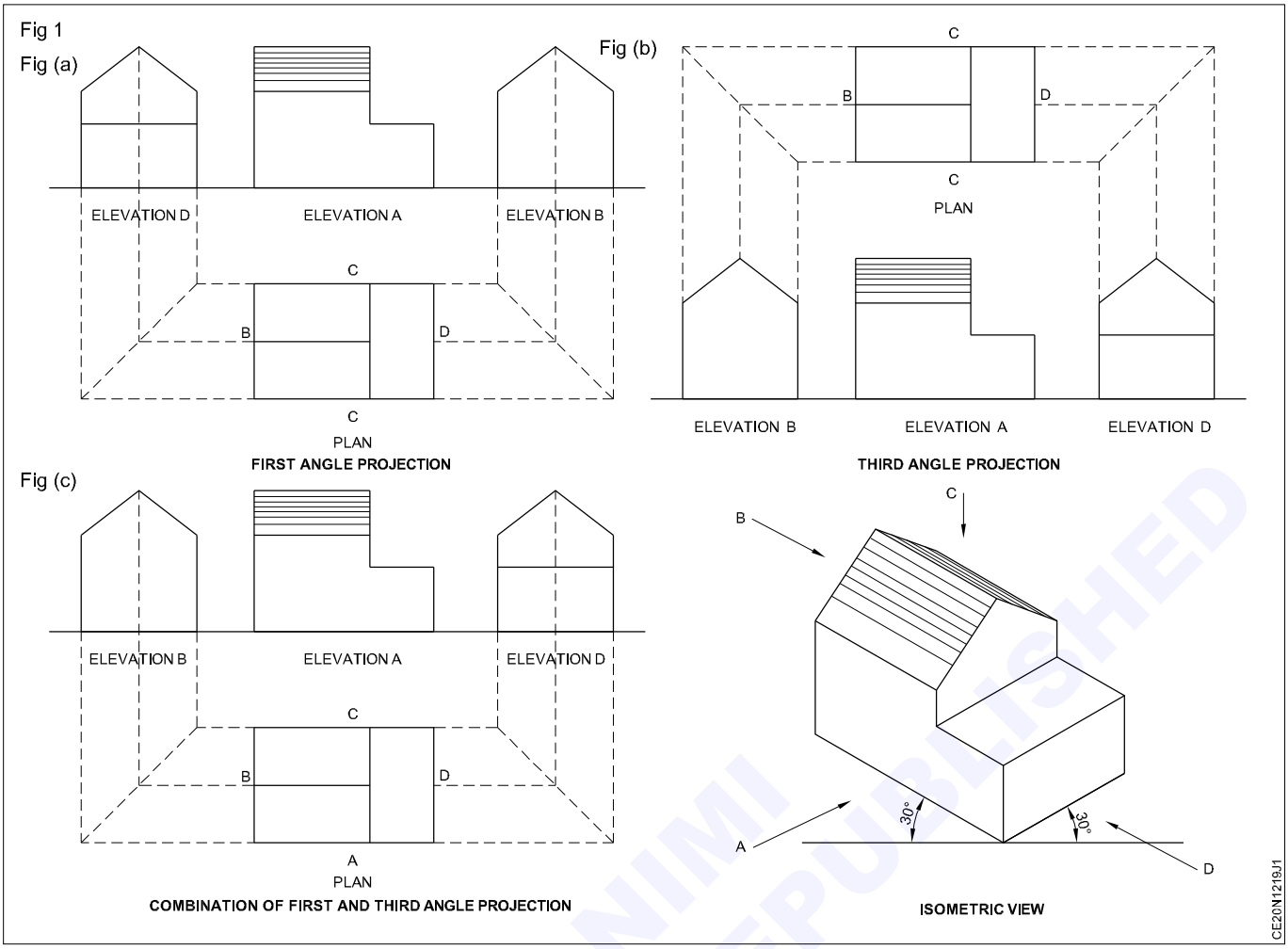
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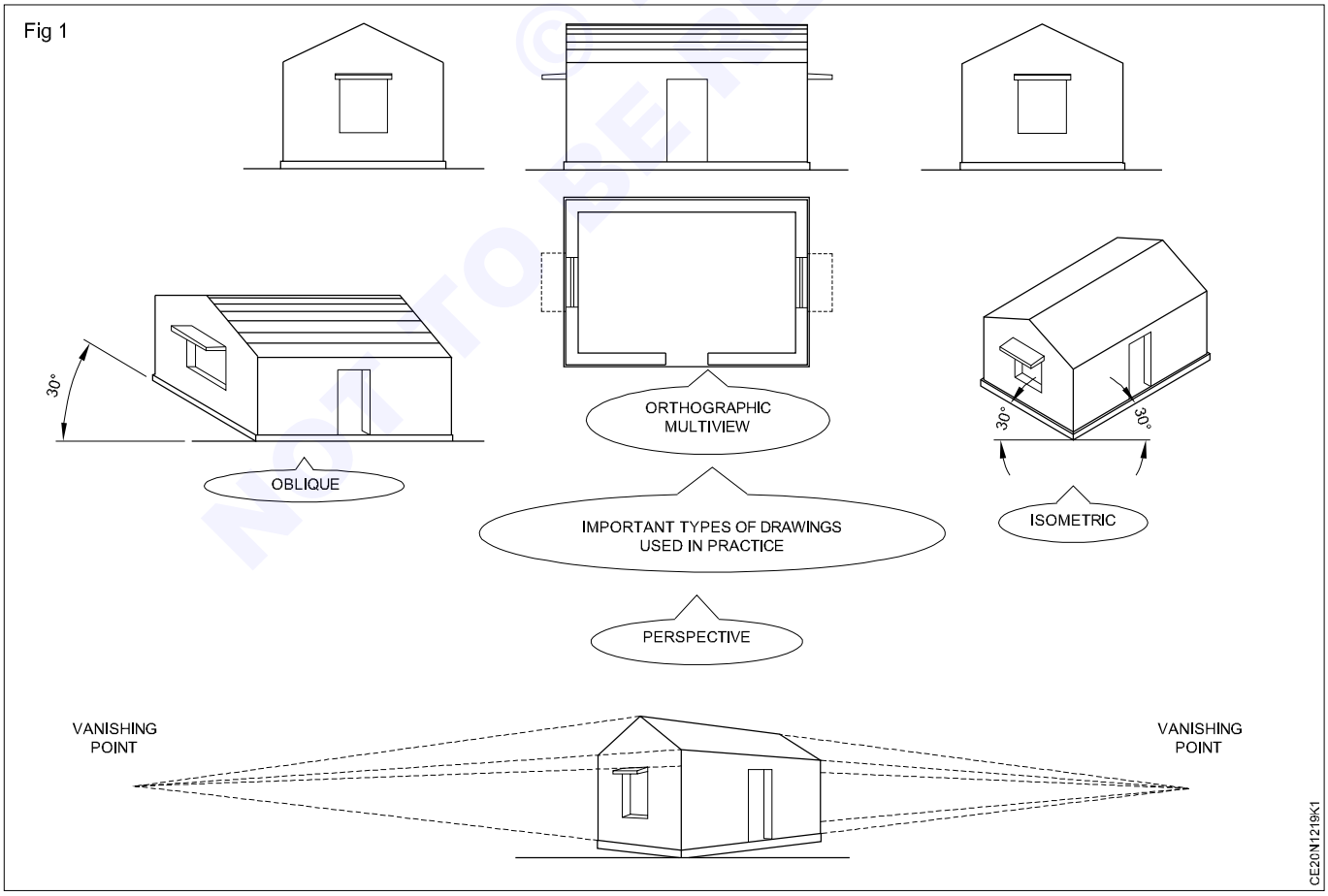
TASK 6: **(Fig 1)**

1 Reproduce the single room drawing and study.

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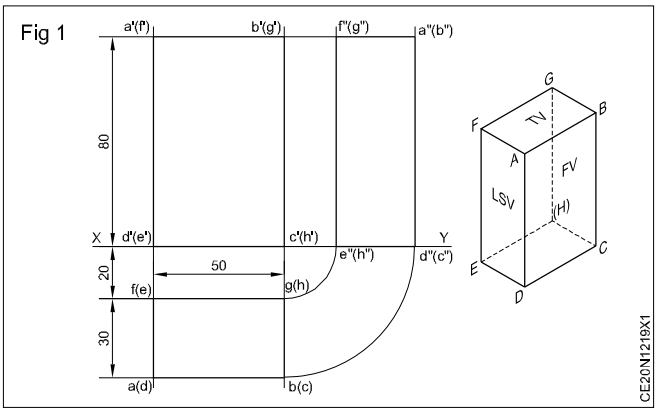


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Projection of solid objects

Objective : At the end of this exercise, you shall be able to,
- **draw orthographic views of solids in the given positions.**

TASK 1 **: Draw the plan, elevation and side view of a rectangular prism of size base 50 x 30 and height 80 mm given its position as below (Fig 1)**



1 The base 50 x 30 is resting on HP.

2 The vertical face 80 x 50 nearest to VP is 20 mm in front of it.

Note: In this task the face of prism are parallel to the planes of projection.

Therefore the plan, elevation and side view will be rectangles.

3 The prism is shown pictorially in the figure and its eight corners are marked as abcd-efgh.

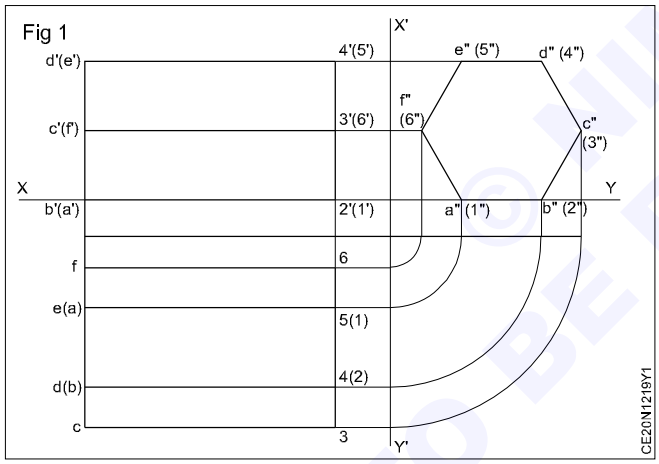
4 Draw the plan (50 x 30) 20 mm below XY line.

5 Project from plan and draw elevation (80 x 50)

6 Draw the side view by drawing projection from elevation and plan. (Fig 1)

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TASK 2 **: Draw the plan, elevation and side view of an hexagonal prism whose side is 25 mm and length 60 mm given its position as below (Fig 1)**



1 One of its lateral surfaces lying on HP

2 The axis is parallel to vertical plane.

From the position described above, it is clear that the hexagonal face of the prism is parallel to AVP. Therefore the end view is a true hexagon and hence this view should be drawn first.

3 Draw the end view (hexagon of side 25 mm) with one side on HP line. (Fig 1)

4 Draw horizontal projectors from side view and complete the elevation. (In the elevation two lateral faces are visible, but they are fore-shortened)

5 Draw projectors from elevation and side view and complete the plan. Three lateral faces are visible, of which one is of true shape and the other two are fore-shortened.

— — — — — — — —

TASK 3 :**Draw the plan, elevation and side view of a cylinder of diameter 40 mm and length 80 mm given its position as below: (Fig 1)**

1 Cylinder resting on the HP with its axis perpendicular to VP.

2 Face farthest from VP is 100 mm away from VP.

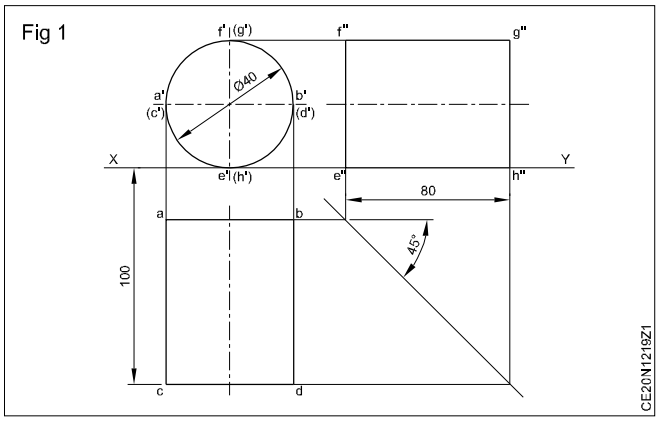
In this task the circular faces are parallel to VP. Therefore the elevation is a circle resting on XY line. Plan and end views are rectangles of size 80 mm x 40 mm.

3 Draw the circle of diameter 40 mm touching XY line. (Fig 1)

4 Draw the plan projecting it from the elevation.

5 Draw the end view by drawing projection on it, from the plan and elevation.

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Section of solids

Objective: At the end of this exercise you shall be able to
- **draw the true shapes / sectional views when geometrical solids are cut by cutting planes.**

TASK 1: **Draw elevation, sectional plan and the true shape of the section of a square prism**

1 Length of side of square prism standing vertically.

2 One diagonal of the base is perpendicular to VP and another diagonal parallel to VP.

3 Cutting plane makes 45° to the axis and intersects the axis 40 mm above the base.

Draw the plan and elevation of the prism (Fig 1)

1 Draw the cutting plane in the elevation of the drawing.

2 From the point m' draw projector to meet the plan at mn.

3 Hatch the portion of the plan and complete the required sectional plan.

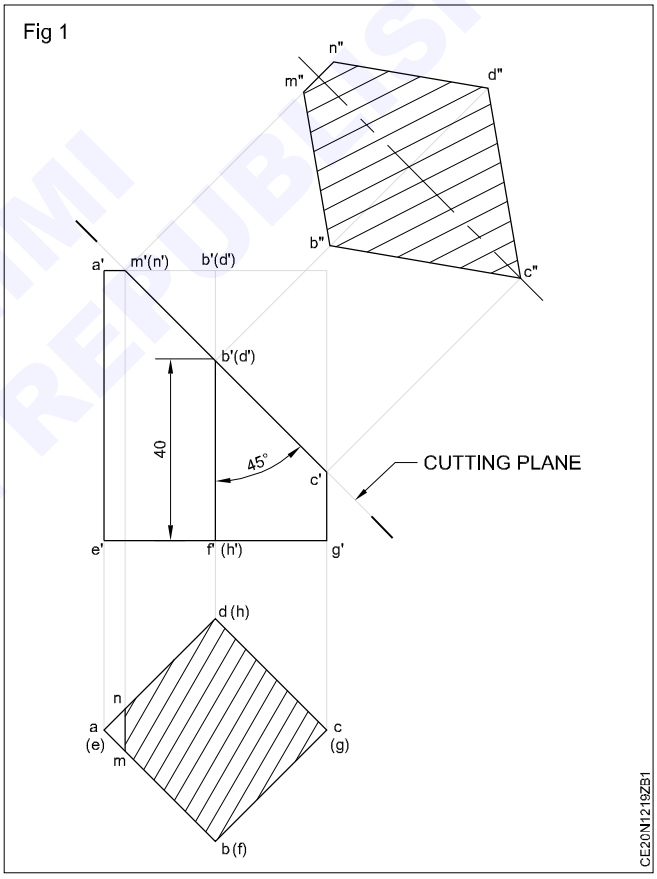
To get the true shape

1 Draw a line parallel to the cutting plane.

2 Draw projectors perpendicular to the cutting plane from points m', b' & c' and extend beyond the line, drawn parallel to the cutting plane.

3 Transfer the distances mn and db symmetrically about the line and also mark c".

4 Join m"-n", n"-d", d"-c", c"-b" & b"-m" and hatch the area to complete the required true shape. (auxiliary view)



TASK 2: **Draw the sectional plan, elevation and true shape of the cut surface of a cylinder given the details as under**

1 Cylinder is of diameter 50 mm and height 60 mm stands on HP with its axis vertical.

2 Cutting plane makes 40° to the horizontal and intersecting the axis at the mid-point of the vertical axis.

Draw the plan and elevation of the cylinder (Fig 1)

1 Indicate the cutting plane in the elevation.

2 Divide the plan into any number of equal parts, (say 12) and mark the points a, b, c... l.

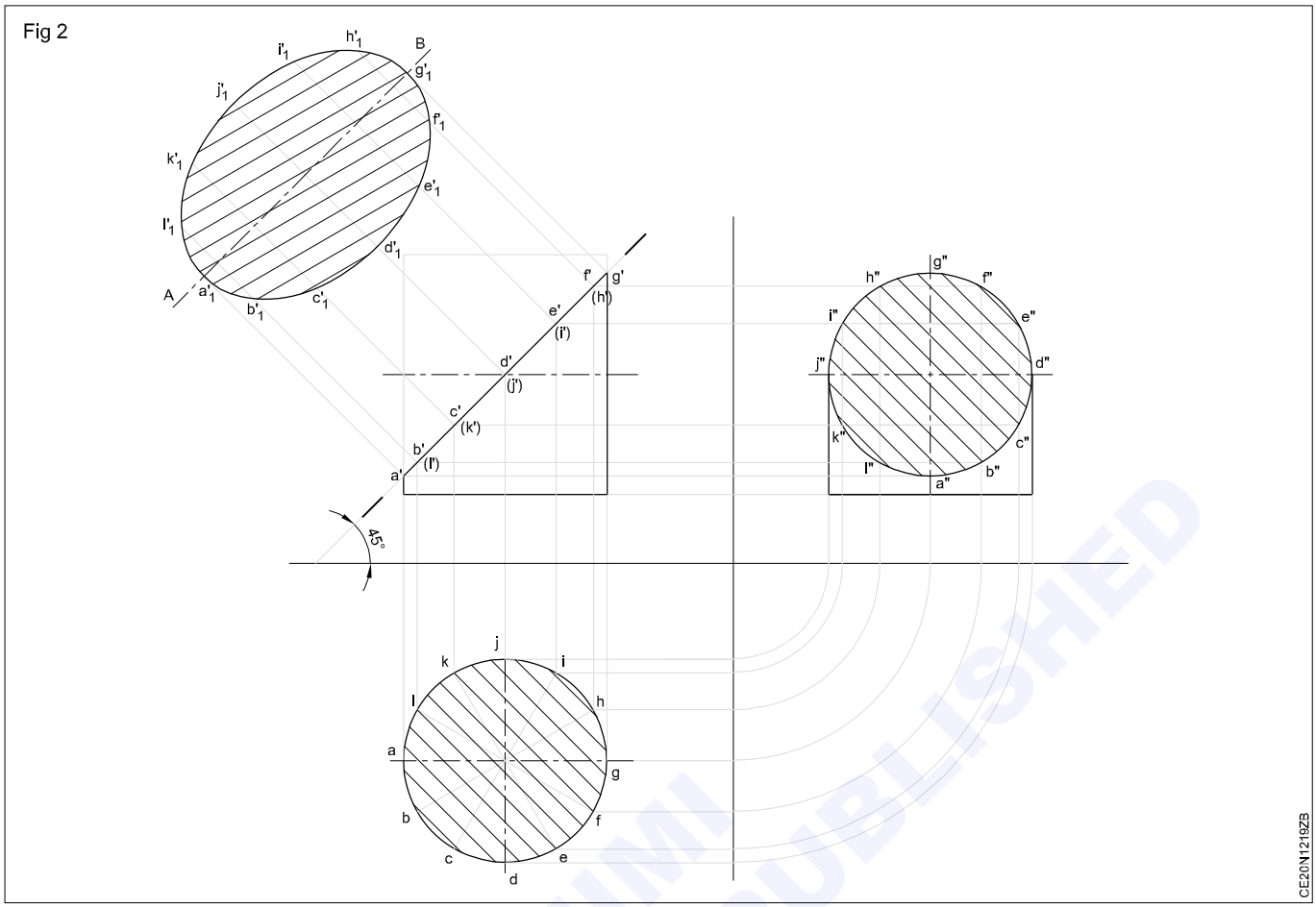
3 Project the points a to l vertically to intersect the cutting plane line at a' b' c' etc.

4 Project horizontally the points a, b, ... l in the plan by transfer method for the side view.

5 Mark the intersection points of the corresponding projection in the previous two steps and complete the end view.

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Fig 2



To draw the true shape of the section

1 Draw a line AB parallel to the cutting plane line.

2 Draw perpendicular projectors perpendicular to the cutting plane line.

3 From points a', b', c' extend beyond the line AB.

4 Mark the points a'_1, b'_1, c'_1 etc such that the distance l'' b'' k'' c'' at in the end view are equal to lb, kc etc in the plan.

Join the points a'_1 b'_1, c'_1 and complete the true shape.

Similarly set off the other 2-6,3-5 by transferring from the plan equals to 2-6. 2-5 respectively. The point 4 obtained by projecting the point 4.

- Join all the points to form a closed figure and hatch the same to get the required true shape of the section

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Isometric, oblique of geometrical solids and perspective views

Objectives: At the end of this exercise you shall be able to
- **construct an isometric scale to a given length**
- **draw the isometric projection of regular solids**
- **draw the isometric views of components with horizontal, vertical, slant and curved surfaces**
- **draw the isometric views for the given multi-views.**

PROCEDURE

TASK 1: **Construct an Isometric scale to measure upto 100 mm with a minimum reading of 10 mm**

1 Draw a horizontal line OA.

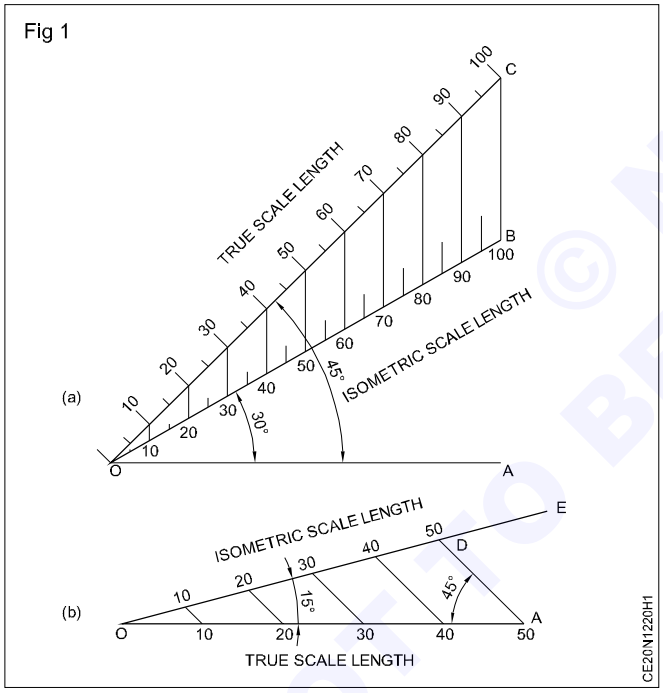
2 Draw a line OC at 45° to OA and mark 10 mm, 20 mm.....100 mm.

3 Draw another line OB at 30° to OA.

4 Draw vertical projectors from divisions on OC on to OB and mark the divisions as on OC.

5 The scale on OC is the true scale and the scale on OB is the Isometric scale. (Fig 1a)

Fig 1



Another way of constructing isometric scale

1 Draw a horizontal OA to a known length. (say 50mm)

2 Draw another line OE at 15° to OA.

3 Draw another line from point A making 45° and meet the line OE at D.

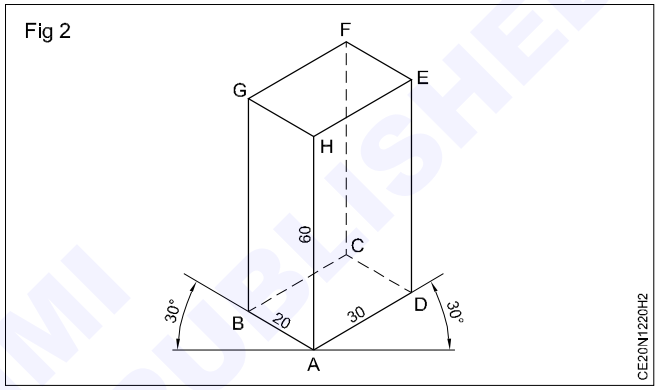
4 Divide the line OA into number of equal divisions (say 5) and mark 10,20,30,40 and 50 mm.

5 From the points on the line OA, draw lines parallel to AD and mark off 10,20,30,40 and 50 on line OE.

6 Now the scale on OA is the true scale and the scale on OD is the isometric scale. (Fig 1b)

Draw the isometric projection of a rectangular prism of base 30 mm x 20 mm and height 60 mm. (Fig 2)

Fig 2



- Use isometric scale for all measurements.
- Draw the lines AB, AD, AH to 20,30 & 60 representing the isometric axes.
- Draw lines parallel to isometric axes as shown and complete the isometric projection required.

Draw the Isometric projection of the hexagonal prism of 2.5 cm side of base and 60 mm height (Fig 3)

1 Draw a hexagon of side 25 mm of its edge is horizontal.

2 Draw a rectangular prism of base pqrs and height 60mm.

3 Draw the isometric view of the hexagonal base abcdef of the prism using offset method.

4 Draw the top hexagonal face by drawing projection from the corners of the base.

5 Make the visible edges by drawing thick lines and draw the invisible edges in hidden line.

6 Rub off the unwanted lines and complete the isometric projection.

Use isometric scale for all measurements

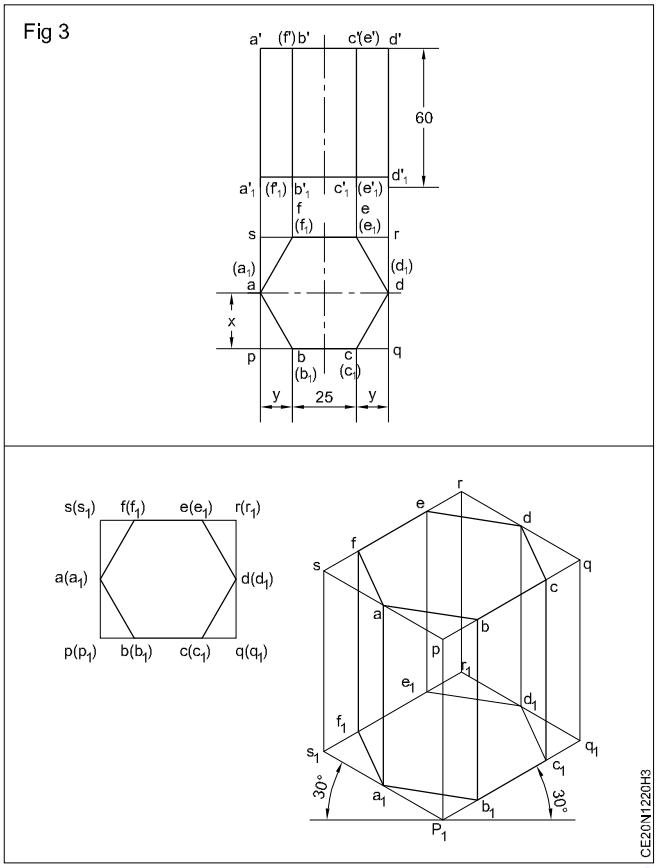
1 Draw the Isometric projection of a cylinder of base 50 mm and height/length of 70 mm with its base resting on HP by offset method and four centre arc method.

Off-set method

1 Draw the elevation and plan of the cylinder. (Fig 4)

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Fig 3



2 Draw the isometric projection of a square of side equals to the dia of cylinder. (Fig 4a)

3 Draw the isometric projection of a square prism of height 70 mm on the square drawn.

4 The mid points of the sides of the square given four points ABCD and four more points HIJG by intersection of the diagonals with circles (located by offset method) join the points to form isometric circle.

5 Draw the isometric circles for the bottom and top face of the cylinder inside the square prism using offset method.

6 Draw common tangents to top and bottom isometric circles.

7 Complete projection by drawing visible lines in thick and invisible lines in thin form. (Fig 4b)

Four Centre arc method

1 Draw the elevation and plan of cylinder. (Fig 4c)

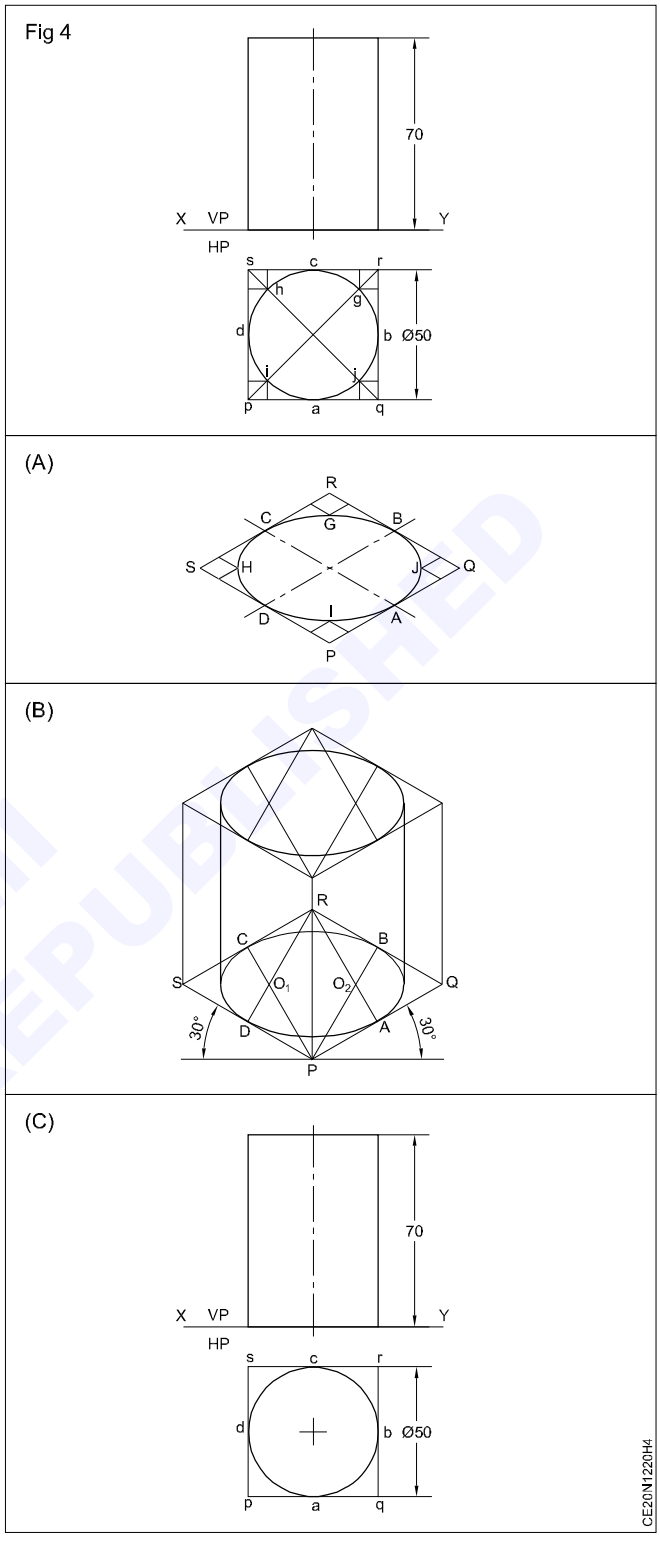
2 Draw the isometric projection of a square of side equals to the dia of cylinder.

3 Draw the isometric projection of a square prism of height 70 mm on the square drawn.

4 Draw the bisectors RD and RA from R and PC and PB from P.

5 Draw arcs with O_1 and O_2 as centres and radius O_1D and O_2A

Fig 4



6 Draw arcs with P and R as centres and radius PC and RD.

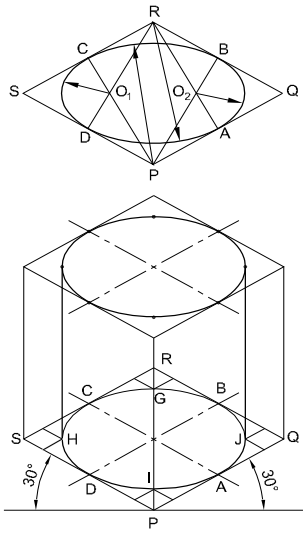
7 Draw vertical lines from the end of the ellipse.

8 Draw the base as half of the ellipse.

9 Complete the isometric view of the prism. (Fig 5)

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Fig 5



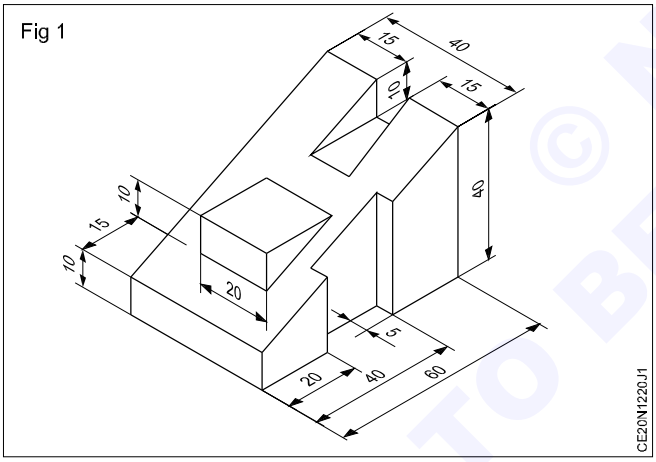
Construction of solid figure

Objective: At the end of this exercise you shall be able to
- **draw the components with horizontal, vertical and slant.**

TASK 1: **Drawing of components**

1 To draw the following blocks (Fig 1 to 3) used the procedure adopted in previous exercises and complete each isometric view of the block.

Fig 1



2 Remove the unwanted lines, draw the remaining in thick and as required.

3 Incorporate all the dimensions shown in the figure.

Fig 2

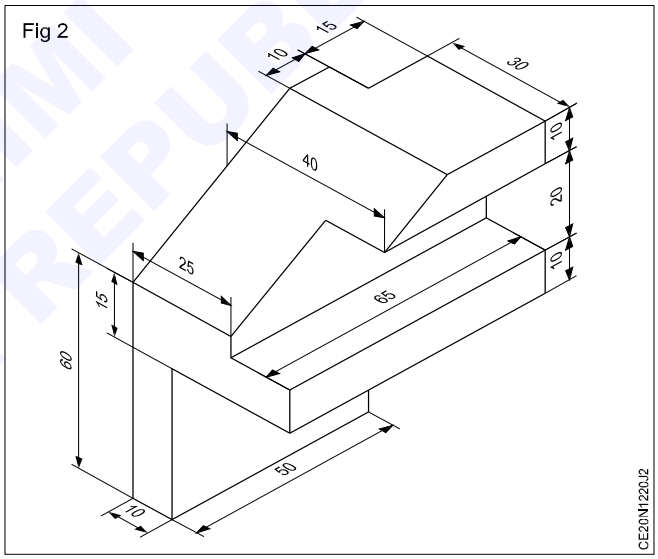
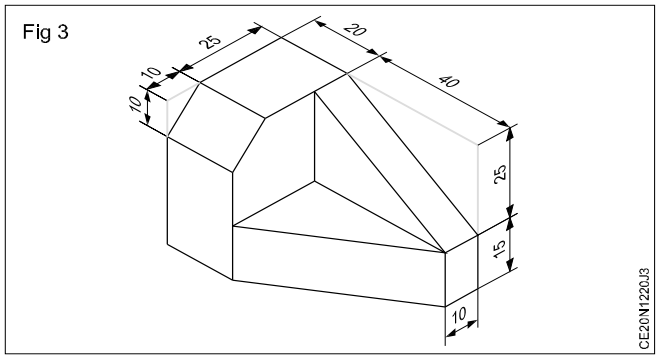


Fig 3



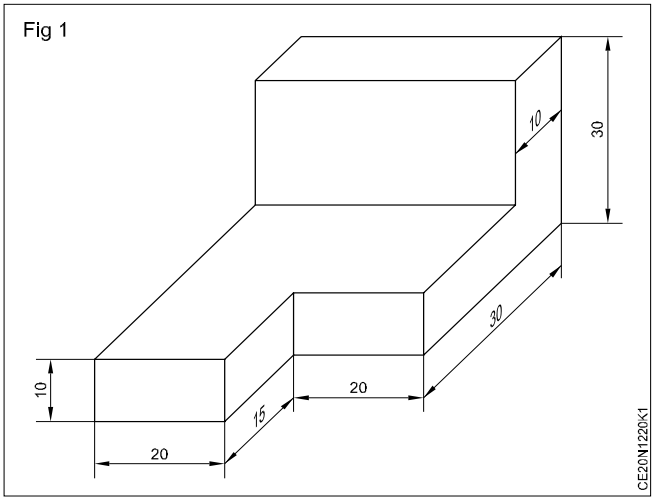
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Oblique projections and perspective view of a stepped block

Objective: At the end of this exercise you shall be able to
- **draw the oblique projections for the given objects.**

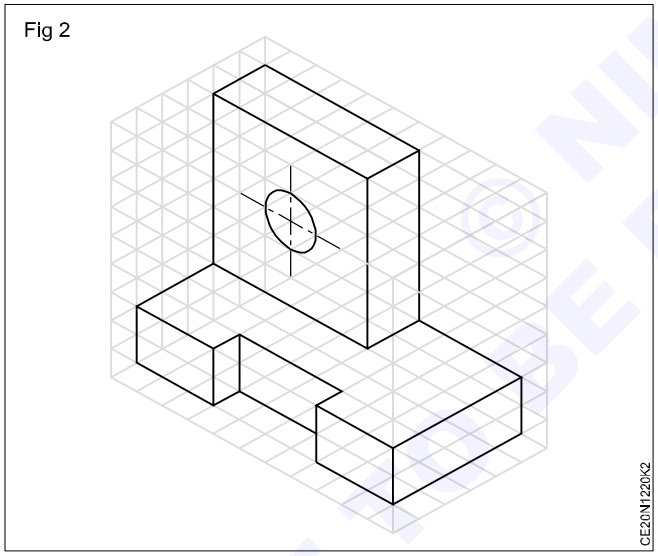
Reproduce the oblique view of the object shown in Fig 1.

Fig 1



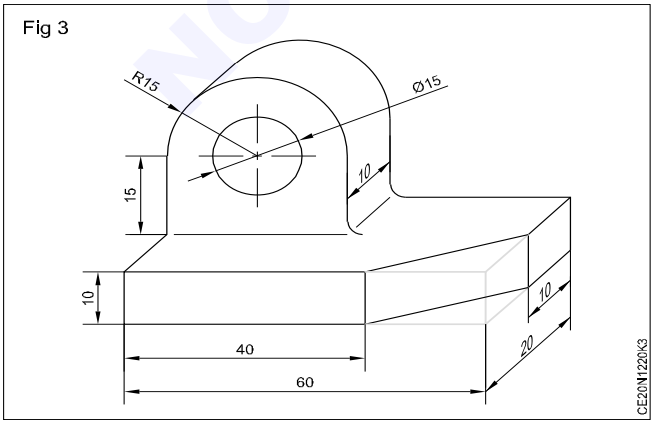
Draw the oblique view in cavalier method of the component shown in isometric view. Consider each gird is of 5 mm. (Fig 2)

Fig 2



Draw the oblique projection in cavalier method of the component shown in isometric view in (Fig 3).

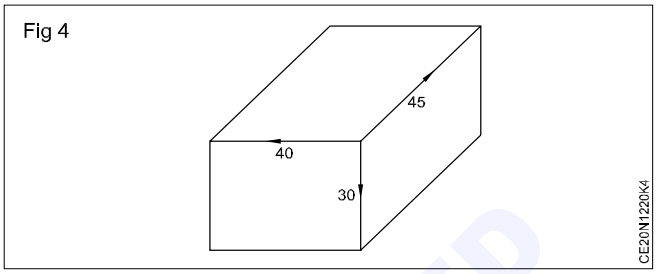
Fig 3



Reproduce the oblique projection of the object shown in

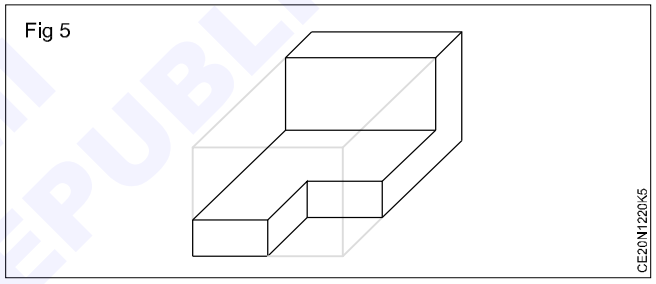
- Draw the oblique axes (may be at any angle to the horizontal 30°, 45° or 60°) and extend. (Fig 4)

Fig 4



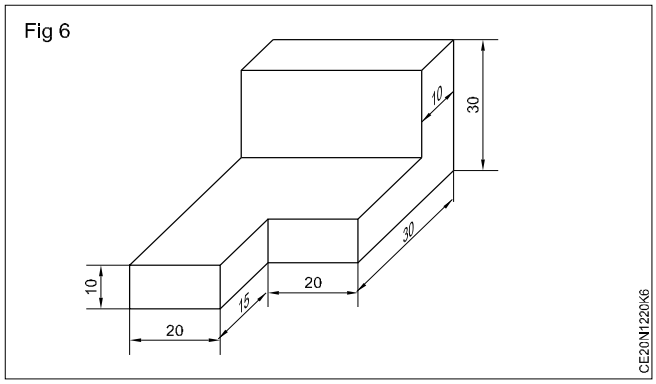
- Mark off the overall length, breadth and height of the object on the axis.
- Draw the enclosed box.
- Envelope the details of the object in the box by transferring dimension. (Fig 5)

Fig 5



- Erase the unwanted lines and darken the required lines of the surfaces. (Fig 6)

Fig 6



- Mark the dimensions and complete the drawing.

(In this oblique projection, the front face of the object is placed parallel to the picture plane and shown in its true size and shape)

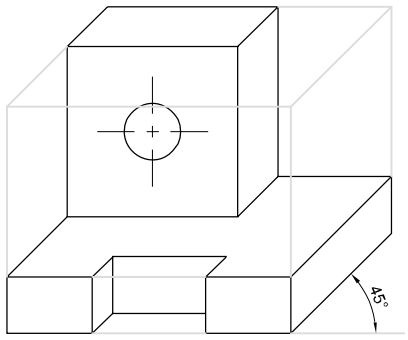
- Draw an enclosed box in oblique view to the overall size of the component i.e 50 x 25 x 40.
- Transfer shape of the view (isometric) to the box.
- Rub off the unwanted lines and complete the oblique view of the component.

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In cavalier method the projectors make an angle of 45 with the plane of projection and the inclined surfaces are drawn 1:1 scale. (Fig 7)

Note : Construct grid of 5 mm in thin lines.

Fig 7



Draw the perspective projections

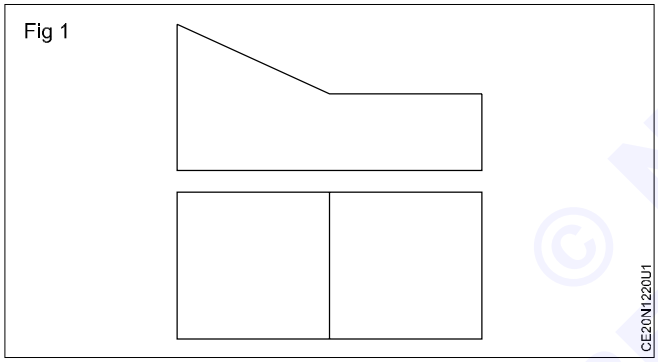
Objectives: At the end of this exercise you shall be able to

- **draw the given objects/component in perspective view by the following method.**
  - **vanishing point method**
    - **i single point perspective**
    - **ii two point perspective/Angular perspective**
  - **visual ray method/multi-view method.**

TASK 1: **Perspective projections**

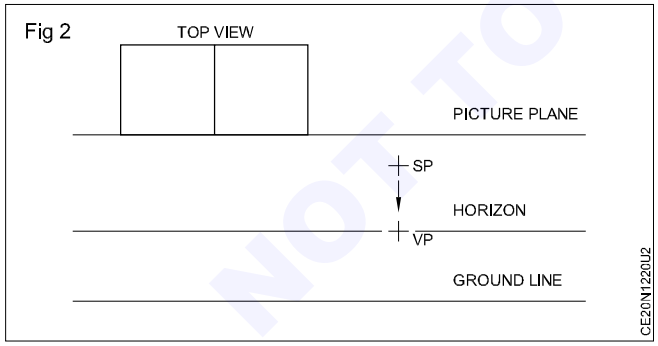
1 Draw the single point perspective view of the given object whose views are given in Fig 1.

Fig 1



2 Draw the plan of the object parallel to picture plane and resting on the pictorial plane. (As shown in Fig 2)

Fig 2



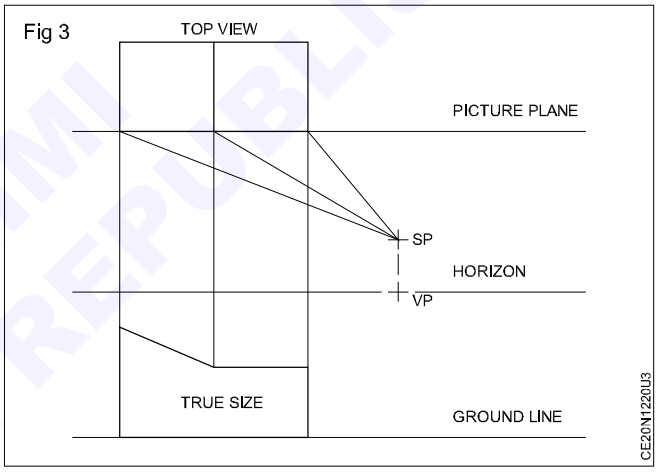
3 Locate the station point in a convenient position as desired.

4 Mark the ground line and the line of horizon plane, where the pictorial drawing is to be drawn.

5 Locate the station point by projecting the station point perpendicular to the horizon.

6 Draw the front view on the picture plane area with its true length and height. (Fig 3)

Fig 3

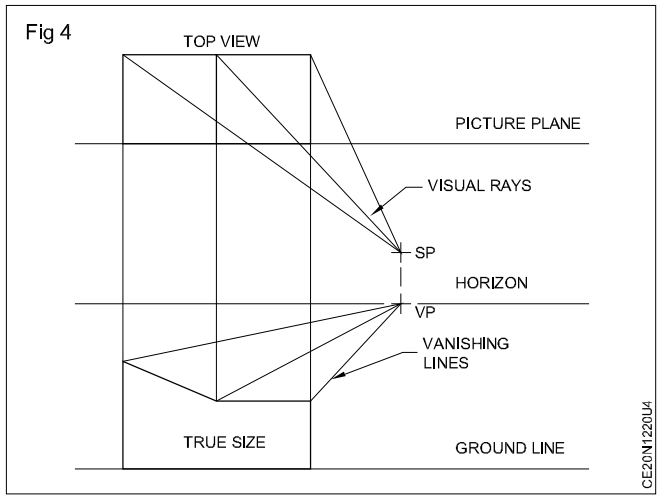


7 From the station point, draw lines from each corner of the object as shown in Fig 3.

8 Draw the projectors from the station point to the other corners of the top view. (Fig 4)

9 From the vanishing point draw lines from each corner of the object as shown in (Fig 4)

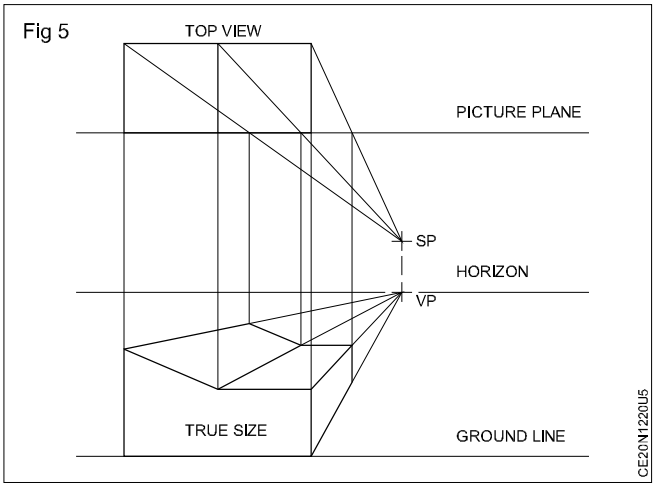
Fig 4



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10 Project the points where the visual lines cross the picture plane in the top view to the pictorial view. (Fig 5)

Fig 5

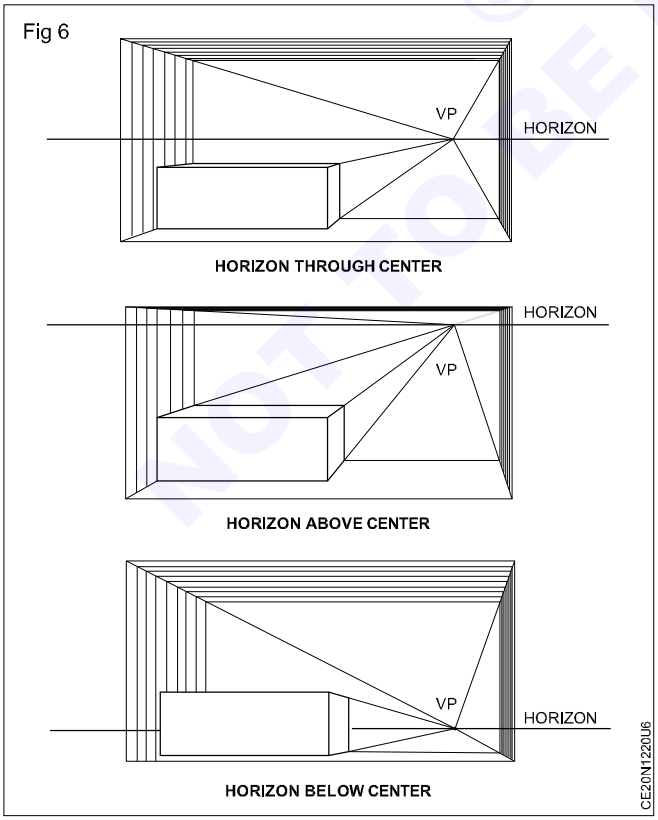


11 Mark the points on the object, where the visual rays intersect, the lines leading to the vanishing point.

12 Join the points to form the one point perspective.

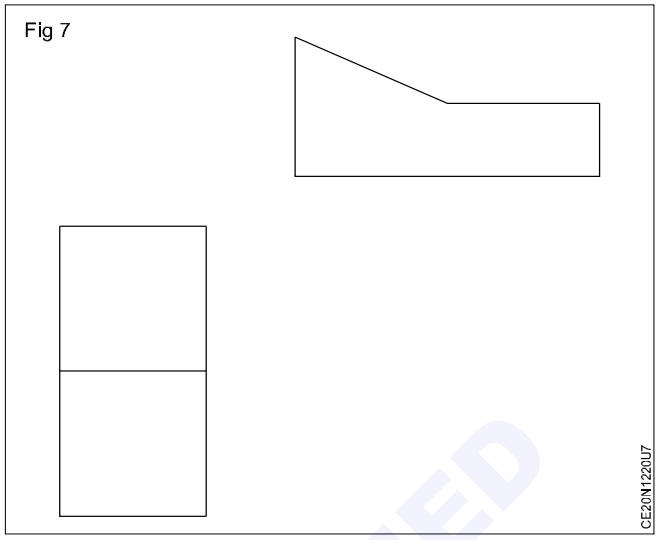
The position of horizon is determined by the desired view of the object. As the horizon is moved above the centre, none of the top view of the object is visible and when it moves below the centre the top view is not visible, the only front view and side view can be seen. Hence when drawing one point perspective, the horizon should be located in such a way that the surfaces should be emphasized as shown in Fig 6.

Fig 6



13 Draw the Fig 7 shown in two point perspective whose top view and side view are given

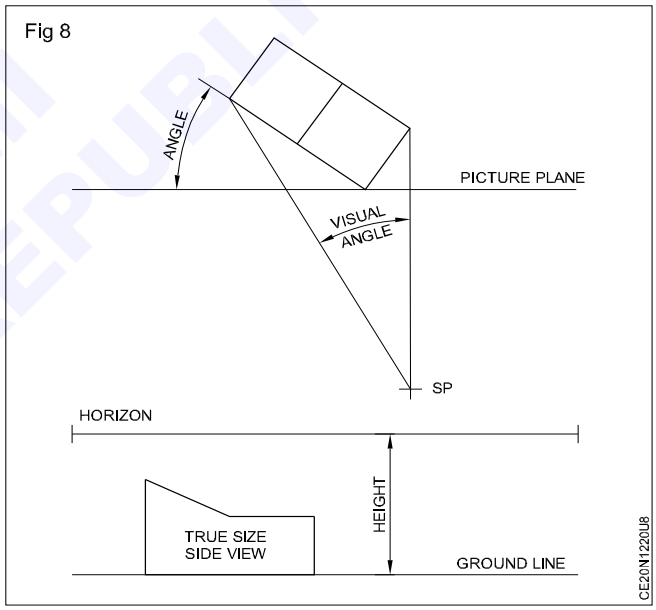
Fig 7



14 Draw the edge of the picture plane.

15 Draw the top view of the object at an angle to the picture plane. (Fig 8)

Fig 8



16 Mark the station point.

Note that visual ray angle is less 30°, so that the entire object is within the 30°, if it is not possible move the station point away from the object.

17 Mark the ground line and horizon.

18 Mark the vanishing points right and left, by drawing the parallel lines with the sides of the top view (Fig 9) from the station point.

19 Join the station points to all the corners of the top view. (Fig 10)

20 The points at which they cross the picture plane are projected, perpendicular to the horizon.

21 Project the corner to the ground line. (It is the true length because it touches the picture plane)

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Fig 9

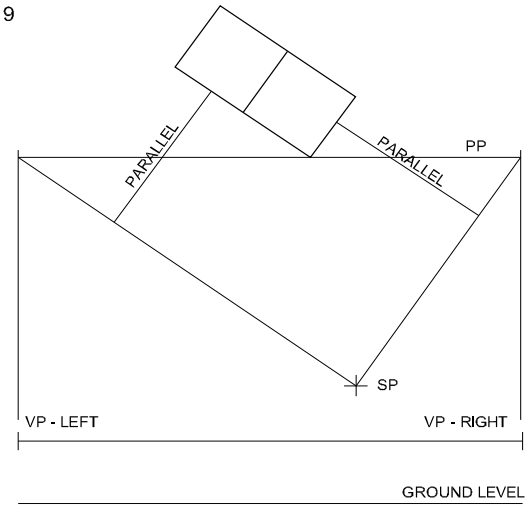
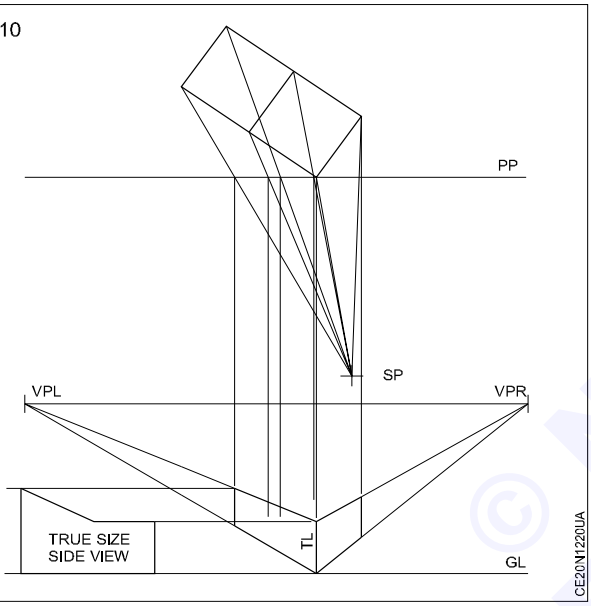


Fig 10



22 Draw the vanishing lines from it to each vanishing point.

23 True height can be projected from the side.

24 Draw the visual rays to the corners of the top view.

25 Project the points where they cross the picture plane to the pictorial view. (Fig 10)

26 The points at which these projectors crossing the vanishing lines are the corners of the object.

27 Project all the corners of the object to the pictorial view.

28 Connect the corners to complete the perspective views. (Fig 11)

Draw the shown object by multi-view method (Fig 12)

1 Draw the top view as shown in Fig 10.

2 Project the top view to form side view.

3 Locate the picture plane and station point for each view.

4 From each station point, draw visual rays to the object in that view.

5 The point at which the rays pierce the picture plane project the perspective view.

6 The point at which the projections of a point from the top and side views cross locates a point at the perspective.

7 The point 4 on the top view and side view of Fig 13 is projected from the edge view of the picture plane to form the perspective drawing.

Fig 11

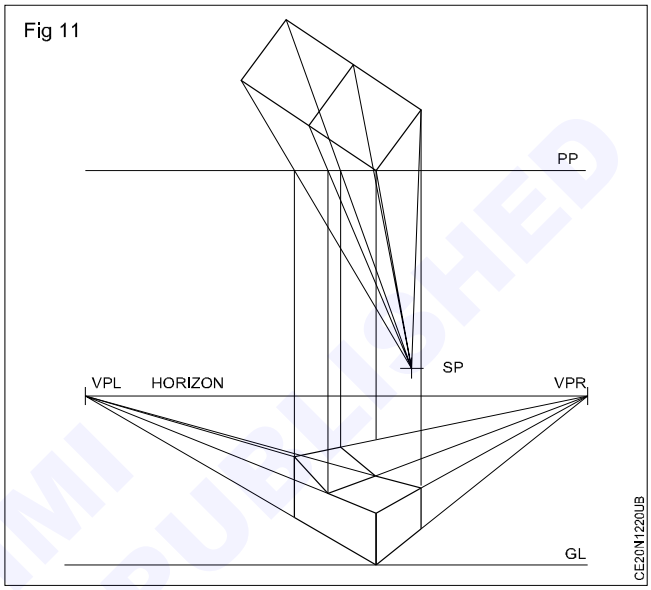


Fig 12

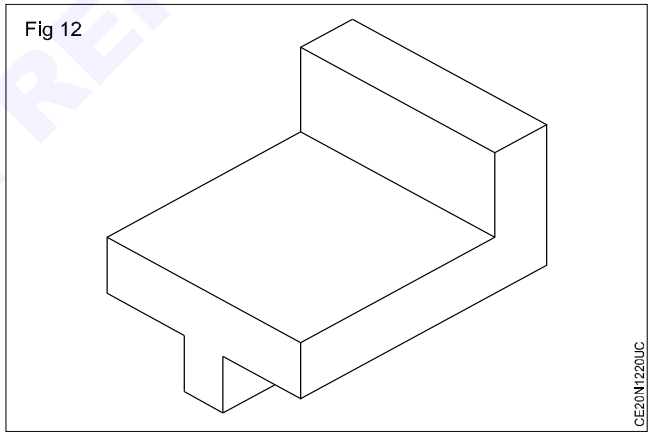
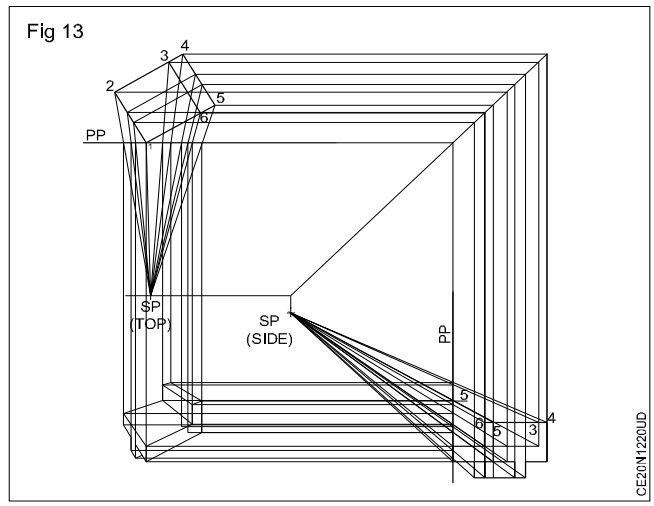


Fig 13



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Drawing of component parts of a single storied residential building (in sectional details)

Objective: At the end of this exercise you shall be able to
- **develop the parts of the building with given details.**

PROCEDURE

TASK 1: **Drawing of component parts of a single storied residential building (Fig 1)**

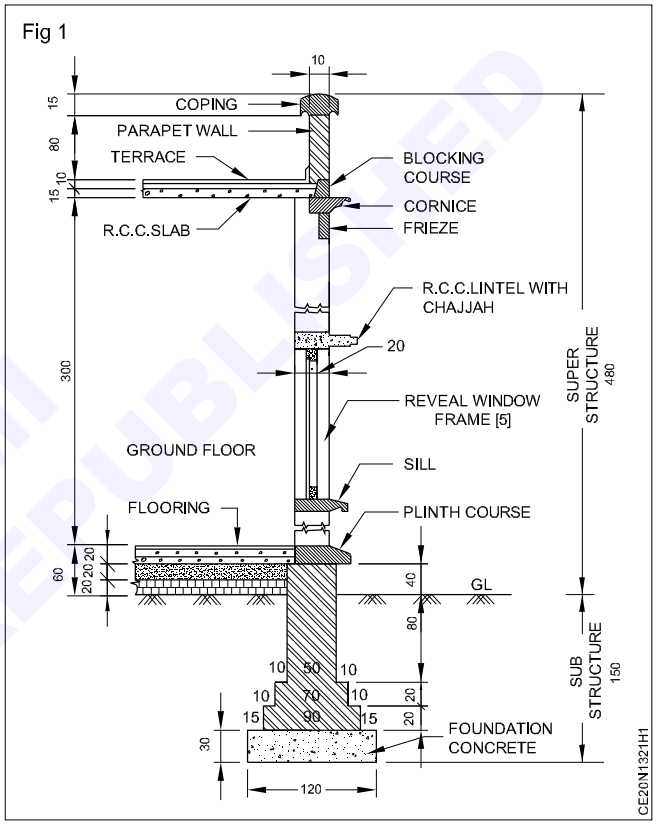
1 With given detailed dimension of the parts of the building, develop the sub-structure plinth, flooring, sill, window, R.C.C lintel with chajjah string coarse, roof, parapet wall and coping.

Data

- Width of foundation = 120 cm
- Height of sub structure = 150 cm
- Height of super structure = 480 cm
- Height of basement = 60 cm
- Height of window = 120 cm
- Size of lintel = 20 x 20 cm
- Projection of chajjah = 60 cm
- Height of room = 300 cm
- Roof slab thickness = 15 cm
- Weathering course thickness = 10 cm
- Parapet wall height = 80 cm

Complete the drawing of component parts of a single storied residential building.

Fig 1



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Function of keys and practice of basic commands

Objectives: At the end of this exercise you shall be able to
- **function of keys and basic commands**
- **start auto CAD four ways.**

PROCEDURE

TASK 1: **Function of keys and basic commands**

Hardware

1 **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.

2 **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.

3 **Memory (RAM)**: Your CPU needs memory to hold pieces of information while it works. While this information’s 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,

4 **Input/output devices:** Input devices accept data 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.

5 **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 hard discs, etc.

Software

1 **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 amount of memory available.
  - c Checks to see if the memory is functioning properly.
- The second step is searching for a specific program called the operating system. When the computer 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.
  - c The operating system is now ready to accept commands form you. The operating system continues to run until the computer is turned off. Examples of operating 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

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

2 There are basically four major categories:

3 Business. Utility, Personal, and Entertainment.

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

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5 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.

6 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.

7 Entertainment application software are video games, puzzles, flight simulators and even educational programs.

Starting AutoCAD

1 To Start 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.

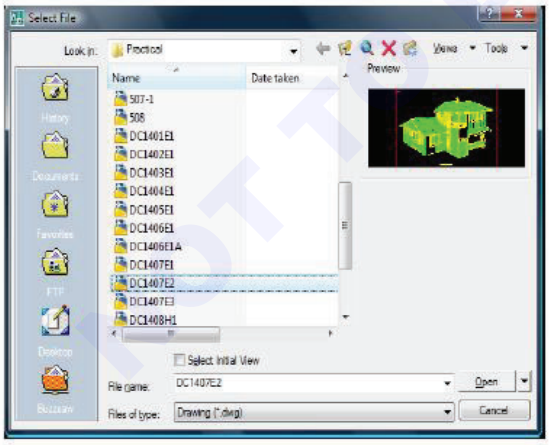
2 Prefer these dialog boxes for trainee new to AutoCAD. But after you become an "expert" you may disable this option.

3 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 (Fig 1)

1 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.** (Fig 1)

Fig 1

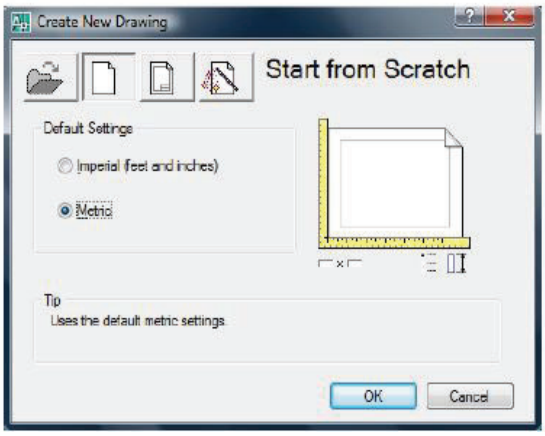


Start from scratch (Fig 2)

1 Allows you to begin a new drawing from scratch. Starting from scratch means all settings are preset by AutoCAD.

2 You must select the measurement system on which to base your new drawing; Imperial or Metric.

Fig 2

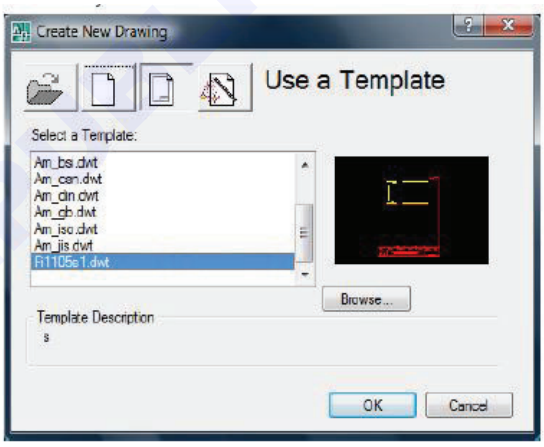


Use a template

1 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 (Fig 3)

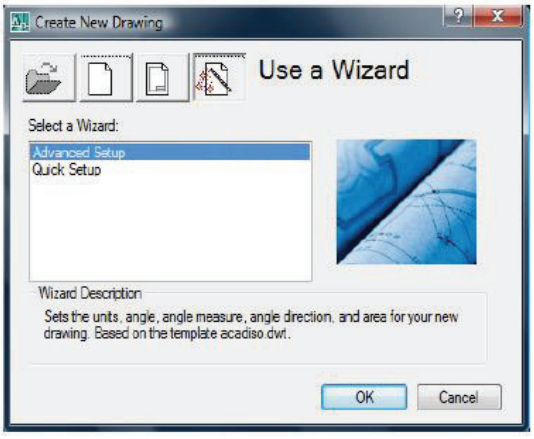
Fig 3



Use of a wizard

1 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. (Fig 4)

Fig 4

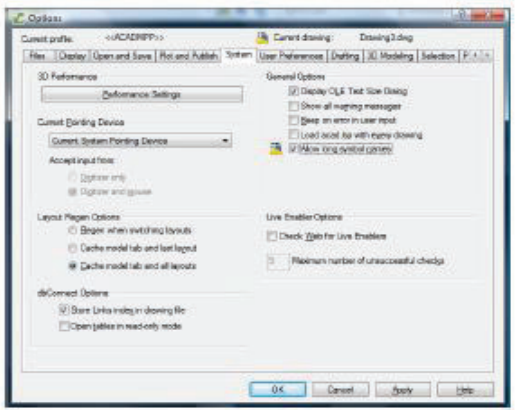


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Opening AutoCAD (Fig 5)

1 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.

Fig 5



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.

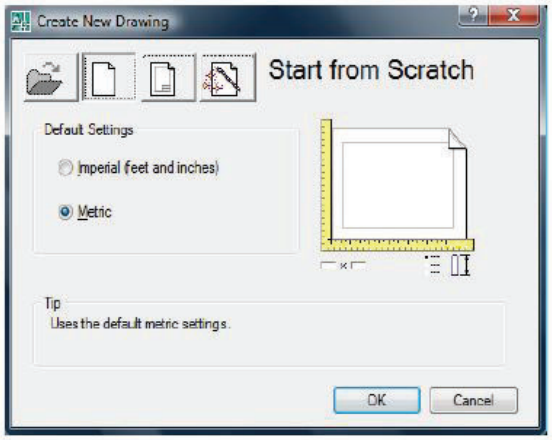
1 Open a drawing: To open an already saved drawings.

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. (Fig 6)

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.

Fig 6



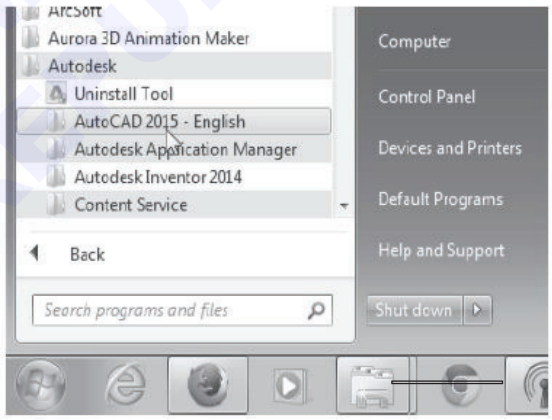
3 Use a template: Starts a drawing based on a drawing template file.

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 (Fig 7)

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

Fig 7

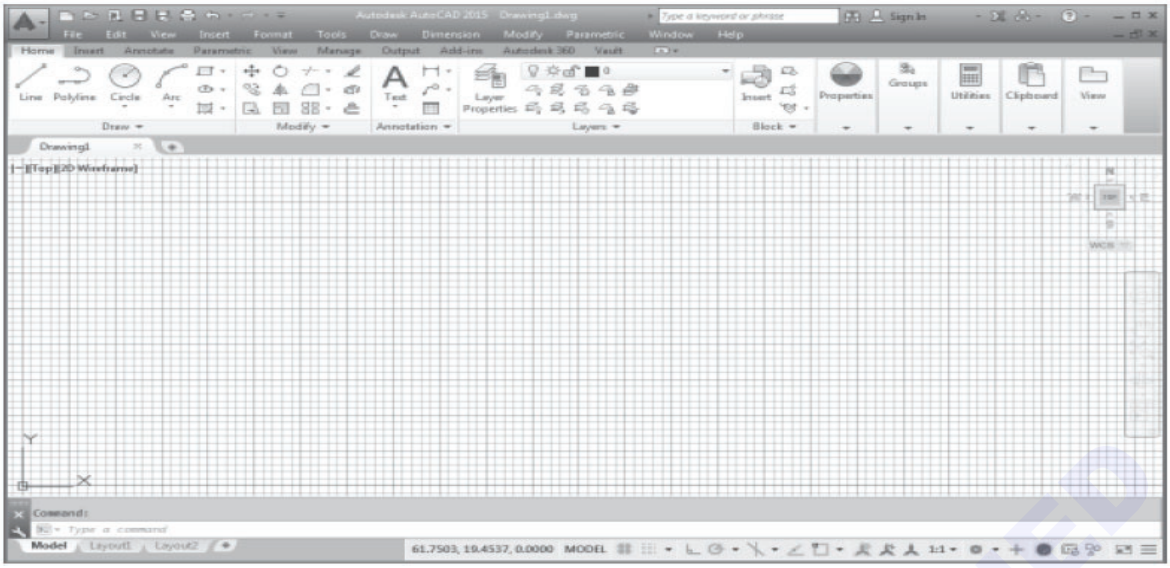


2 Once one program is loaded into memory, the AutoCAD drawing screen will appear on the screen. (Fig 8)

3 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.

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Fig 8



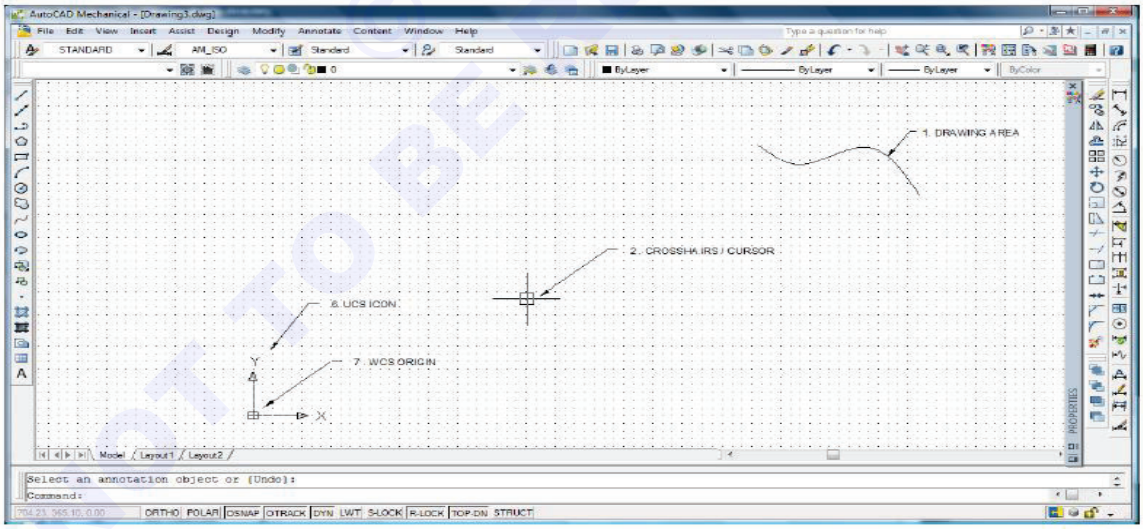
Getting familiar with the auto CAD window

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

TASK 1: **Getting familiar with the auto CAD window**

1 Before you can start drawing you need to get familiar with the AutoCAD window. In the following lessons, You will be referring to all the areas described below. (Fig 1)

Fig 1



2 So it is important for you to understand each of them. But remember, this page will always be here for you.

1 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.

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.

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3 Command line

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

4 Coordinate display (F6)

- **Location:** Lower left corner.
- In the Absolute mode (cords = 1) displays the location of the crosshairs / cursor in reference to the origin. The first number represents the horizontal movement (X axis), 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 (cords = 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 until y ou 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 paper space and model space.

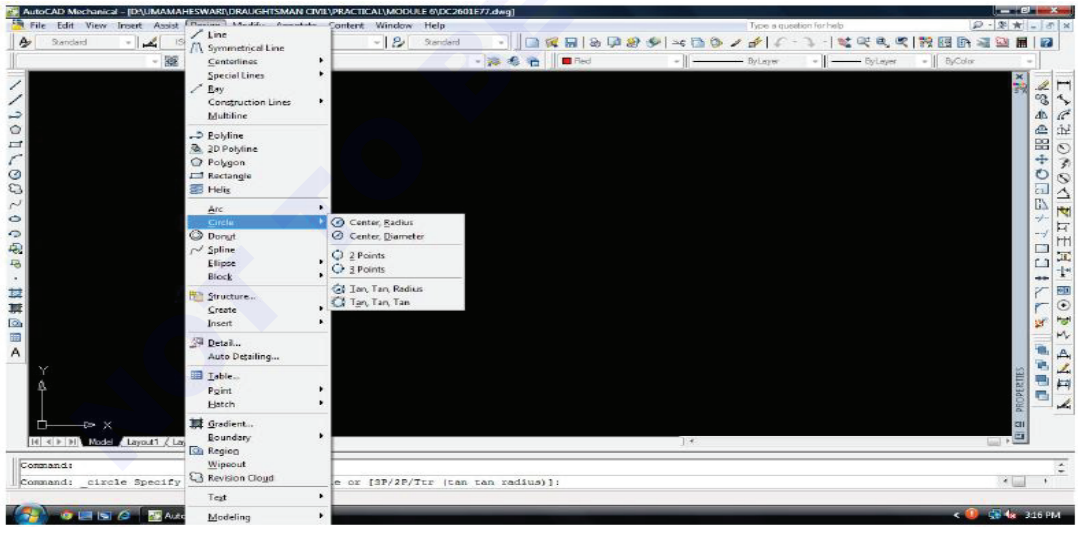
6 UCS ICON (User coordinate system) (Fig 2)

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

Fig 2



FUNCTION KEYS

F1	Help	Explanations of commands.
F2	Flip screen	Toggles from Text Screen to Graphics Screen.
F3	Osnap	Toggles Osnap On and off.
F4	Tablet	Toggles the tablet On and Off.

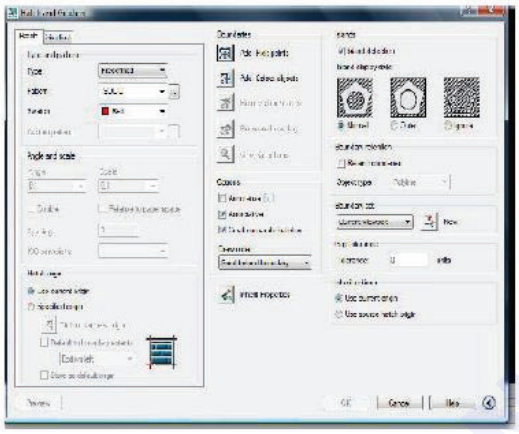
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F5	Isoplane	Changes the Isoplane from Top to Right to Left.
F6	Coordinate display	Changes the display from ON/Off/
F7	Grid	Toggles the Grid On or Off.
F8	Ortho	Toggles Ortho On or Off.
F9	Snap	Toggles Increment Snap on or off.
F10	Polar	Toggles Polar Tracking On or Off.
F11	Otrack	Toggles Object Snap Tracking On and Off.

8 Special key functions (Fig 3)

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

Fig 3



- **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.

9 Pull-down "MENU BAR" (Fig 4)

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

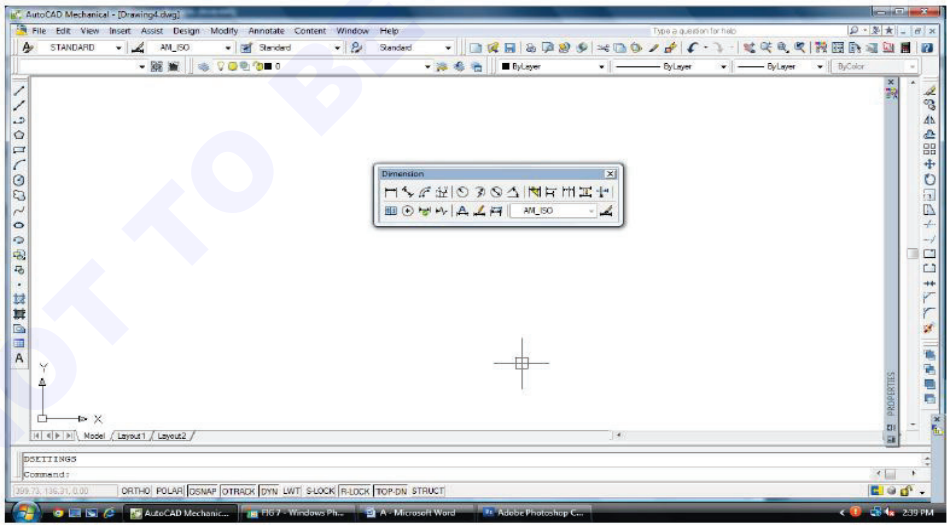
2 file edit view insert format tools draw dimension modify express window help.

3 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....)

10 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.

Fig 4



11 Tool bars

- 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.

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Use of Elementary commands by CAD, tool bar

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

PROCEDURE

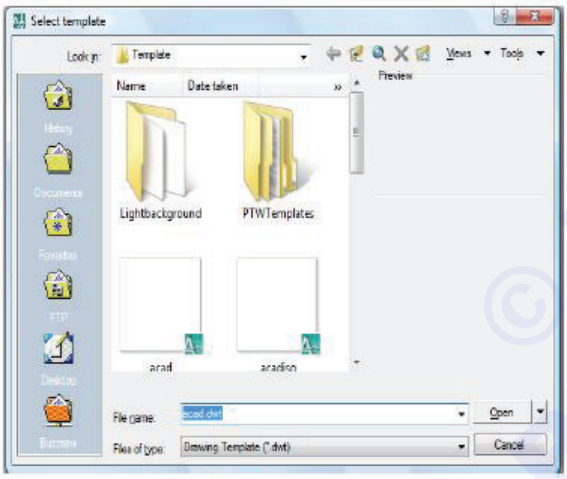
TASK 1: **Practice on elementary commands by CAD, tool bar**

Starting a new drawing

1 Pulldown menu: file, new.

2 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) (Fig 1).

Fig 1



Opening a template (Figs 2 & 3)

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 learning the AutoCAD commands and hopefully, have some fun.

Fig 2

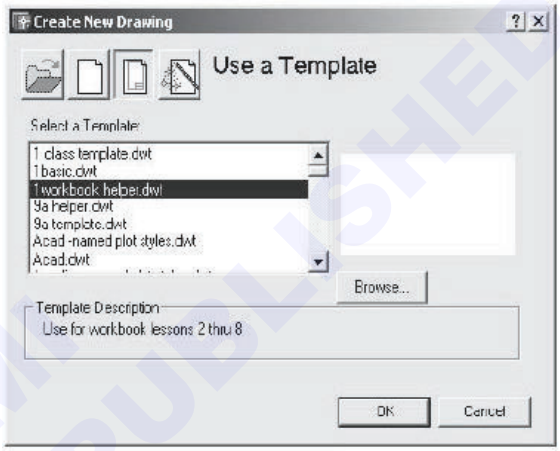


Let's start by opening the "1 Workbook"

1 Select file/new

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

Fig 3



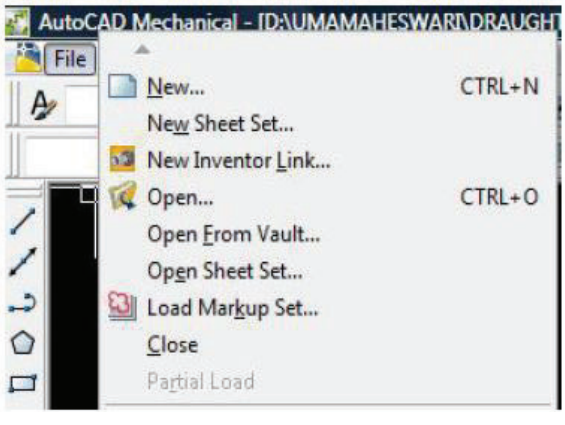
3 Select 1 workbook helper. dwt from the list of templates.

4 Select the ok button.

Create a template

Now you can create a template. This will be a very easy task (Fig 4)

Fig 4



1 Start AutoCAD as follows. (Figs 5 to 9)

Start button/programs/AutoCAD.

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

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Fig 5

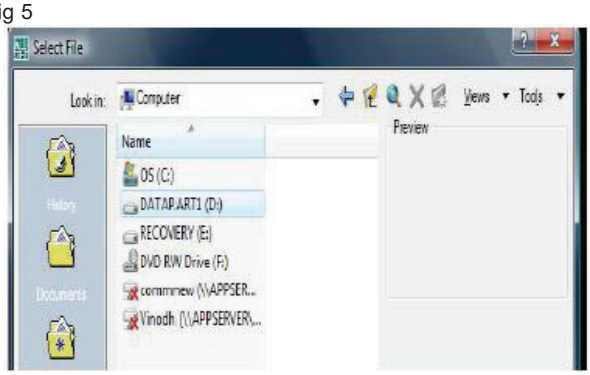


Fig 6

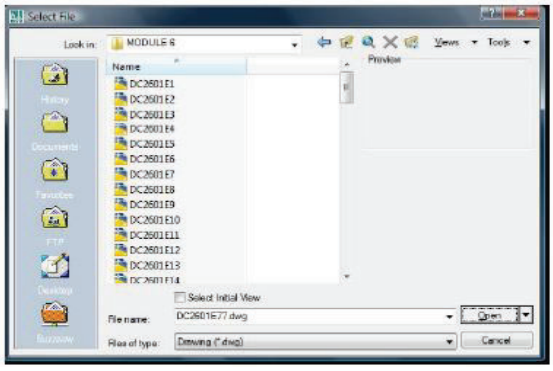


Fig 7

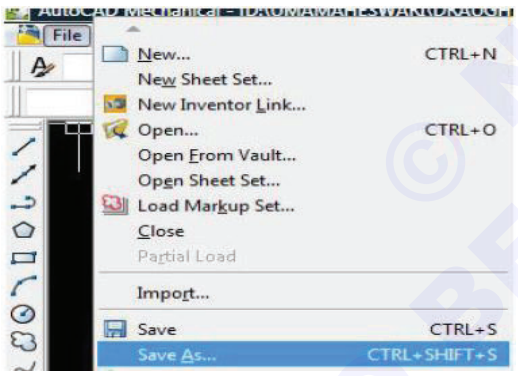
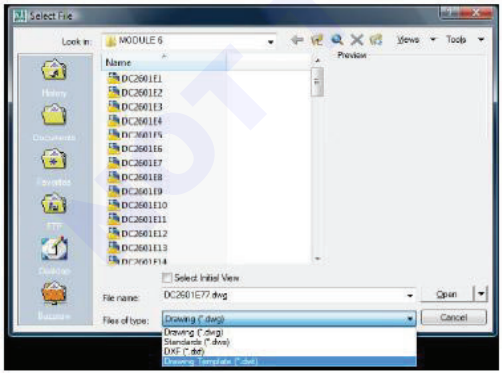


Fig 8



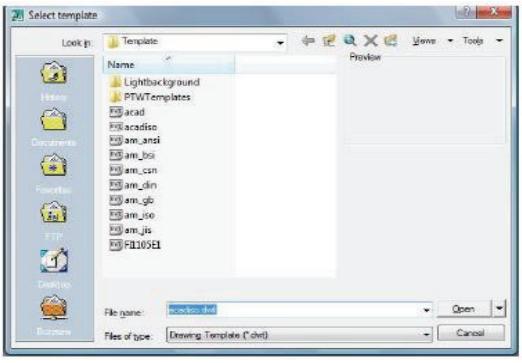
2 Select **file/open.**

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

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

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

Fig 9



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.

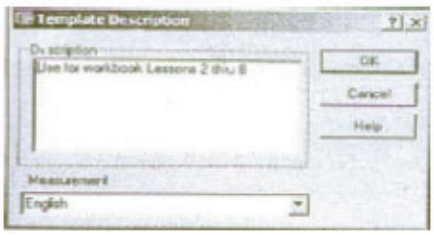
AutoCAD displays numerical first and then alphabetical.

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. (Fig 10)

Fig 10



Creating a new drawing

New command

Create a new drawing file.

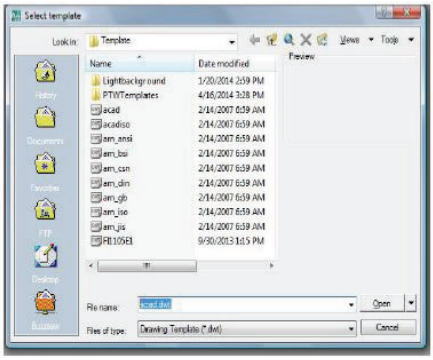
1	Choose	File, new. or
2	Press	Ctrl + N or
3	Click	The new icon or
4	Type	New at the command prompt. Command: new
5	Choose	One of the options for creating a new drawing.
6	Click	The ok button.

7 Save the drawing as another name.

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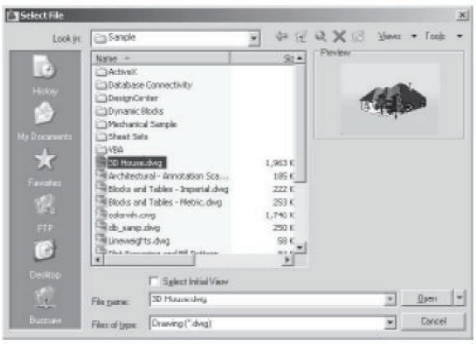
TIP: New drawings can also be created from template files. (Fig 11)

Fig 11



Open existing drawings (Fig 12)

Fig 12



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.

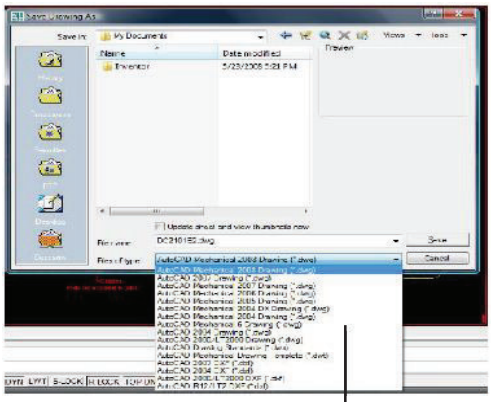
Preview shows a bitmap image of the drawing selected. This image is the view that was last saved in the drawing.

Saving drawings (Fig 13)

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.

Fig 13



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 format 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.

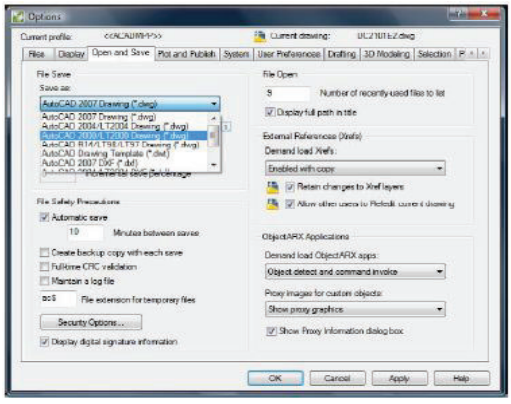
1	Press	Ctrl + S. or
2	Click	The save icon. or
3	Type	Qsave at the command prompt, Command: Qsave.

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

AutoSave settings under Tools, options...

Existing AutoCAD (Fig 14)

Fig 14



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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 drawing 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 (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 (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 (Fig 1)

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] (Fig 2 - 4)

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.

Fig 1

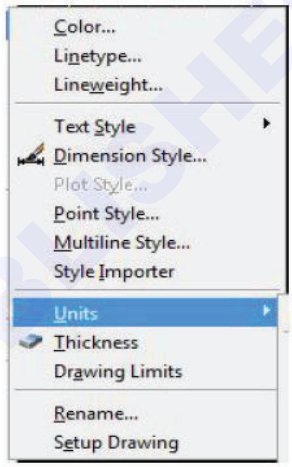
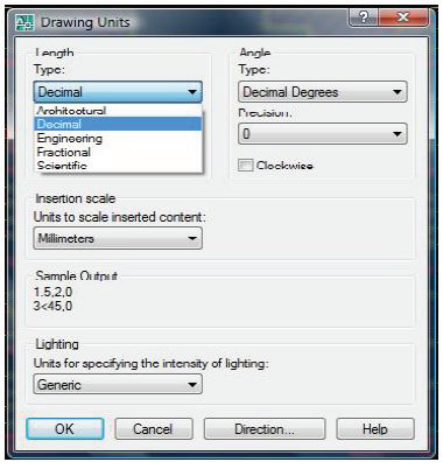


Fig 2



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.

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Fig 3

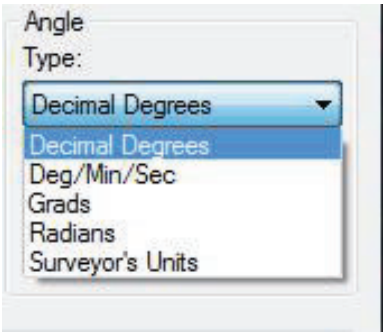
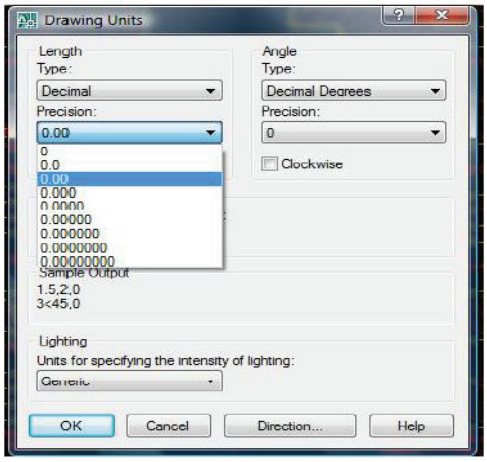


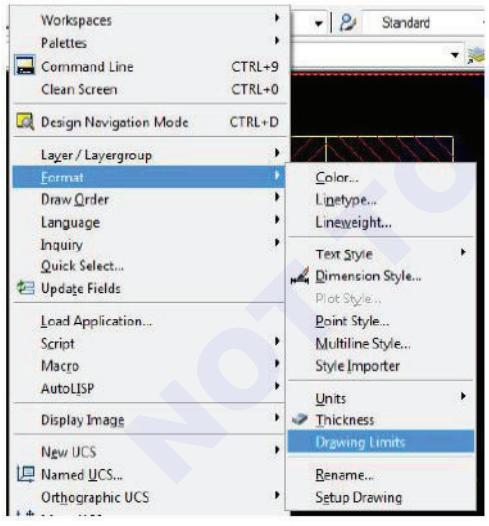
Fig 4



6 Pick ok to exit the drawing units dialog box.

Drawing area setup (Fig 5)

Fig 5



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.

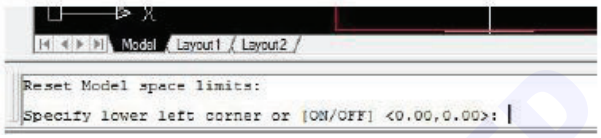
1 In the menu bar select:

[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**>.

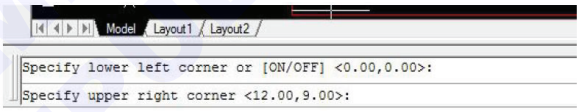
3 In the command prompt area, the message "specify upper right corner <12.00,9.00>" is displayed. Press the ENTER key again to accept the default coordinates <12.00,9.00>. (Fig 6)

Fig 6



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.) (Fig 7)

Fig 7



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

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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 will 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

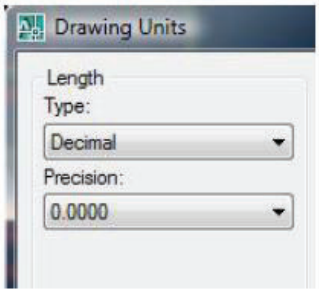
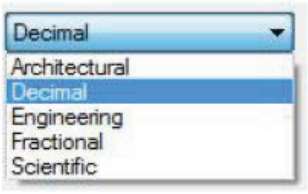
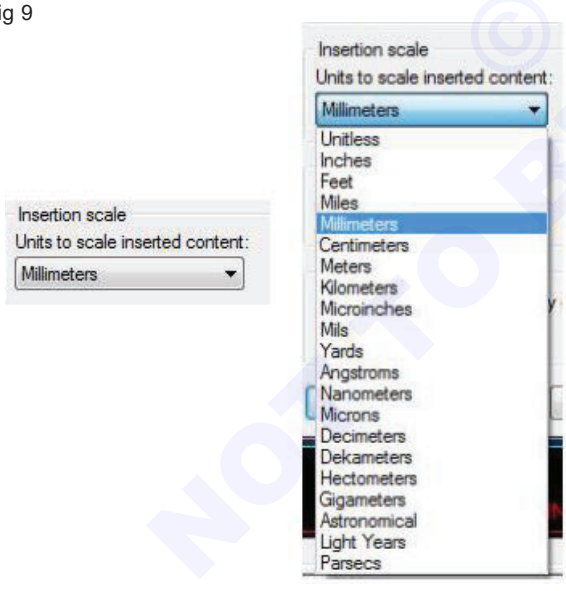
If you enter-units at the command prompt, UNITS displays prompts on the command line. There are five fundamental types of units i.e. Decimal, architectural, engineering, fractional & scientific.

The text window displays the following prompt.

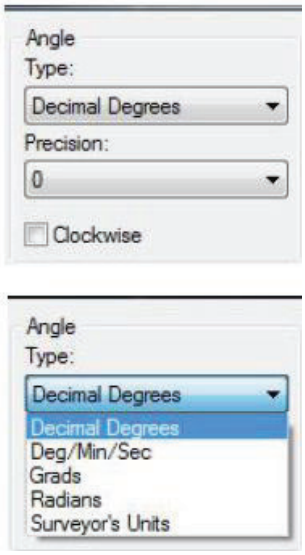
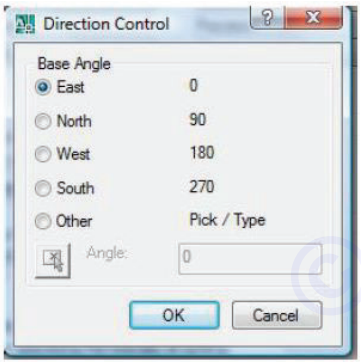
There are five fundamental types of units i.e. Decimal, architectural, engineering, fractional & scientific.

There are five fundamental types of units i.e.

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Icon/Button	Description
Fig 8   	Decimal, Architectural, Engineering, Fractional & Scientific. (Fig 8) 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
Fig 9  	**Inserting scale (Fig 9)** 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.

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Icon/Button	Description
Fig 10 	The next prompts is for angle formats and precision. (Fig 10) System of angle measure: (Example) 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.
Fig 11 	The next prompt is for the direction for angle 0. (Fig 11) **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 counter clockwise. 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. (Fig 1)

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Fig 1

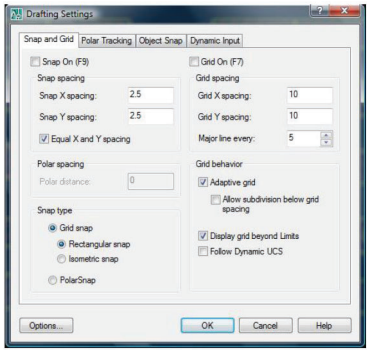
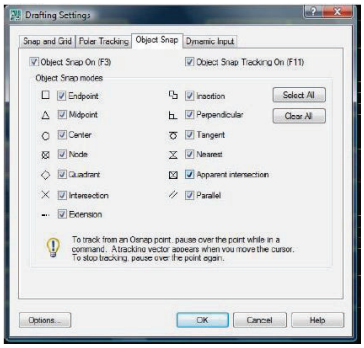


Fig 2



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 (Fig 2)

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, midpoint, 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. (Fig 3)

Fig 3



Grid on (Figs 4 to 6)

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.)

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 lines 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 plotter drawing. 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. (Fig 7 to 9)

Fig 4

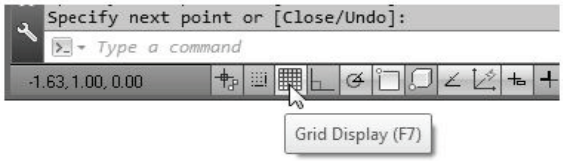


Fig 5

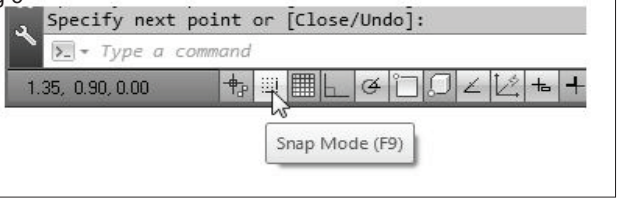
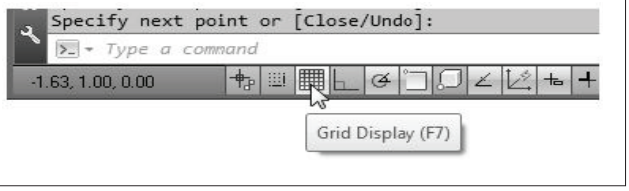


Fig 6



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Fig 7

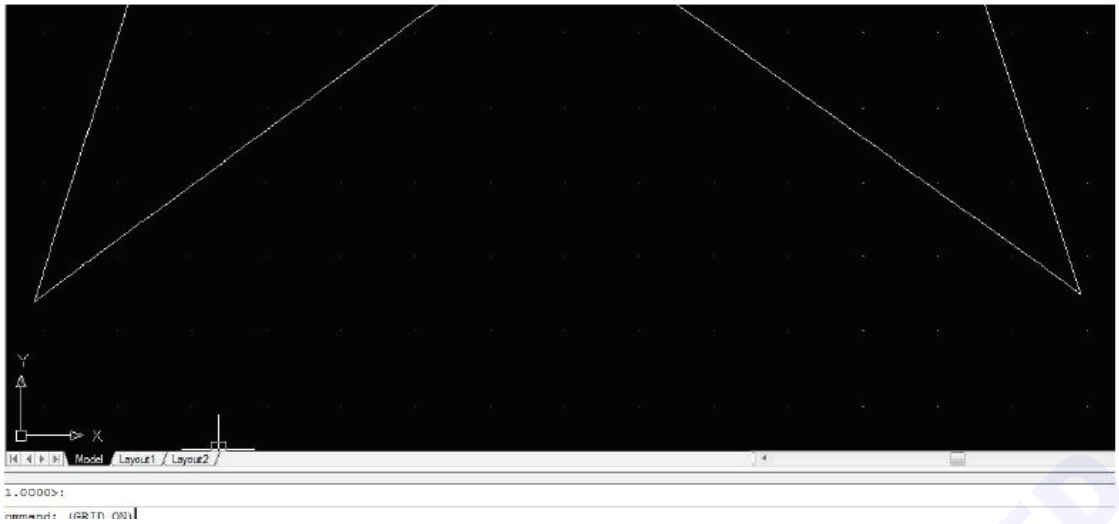
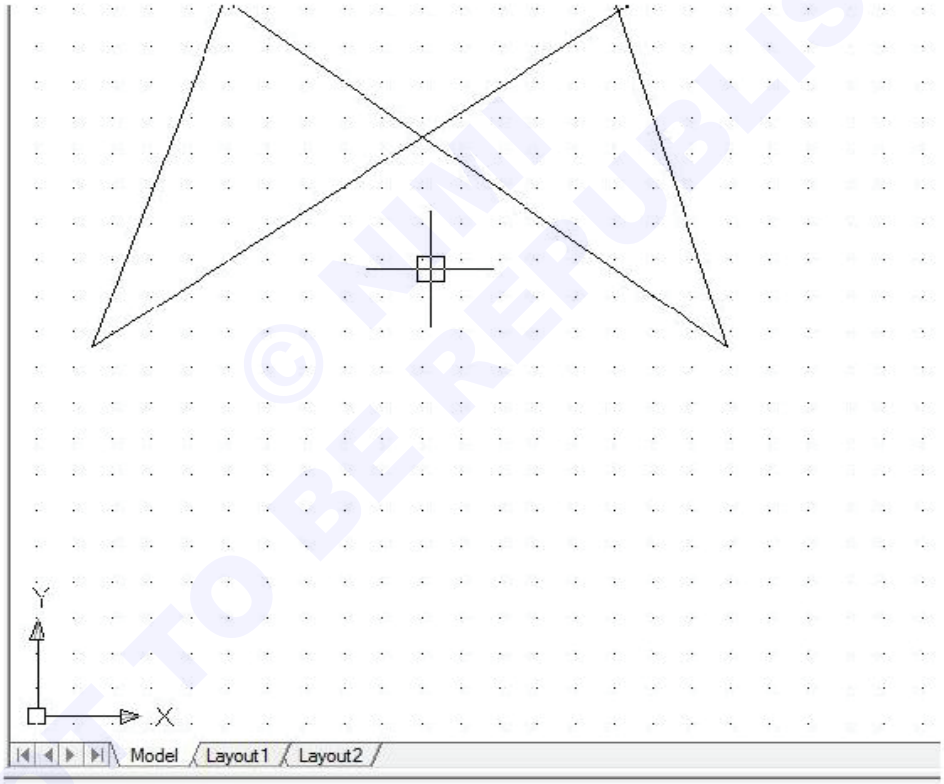


Fig 8

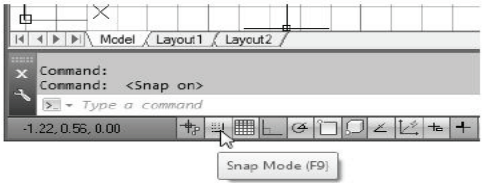


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Snap mode on

1 Left- click the snap mode button in the status bar to turn on the snap option. (Fig 10)

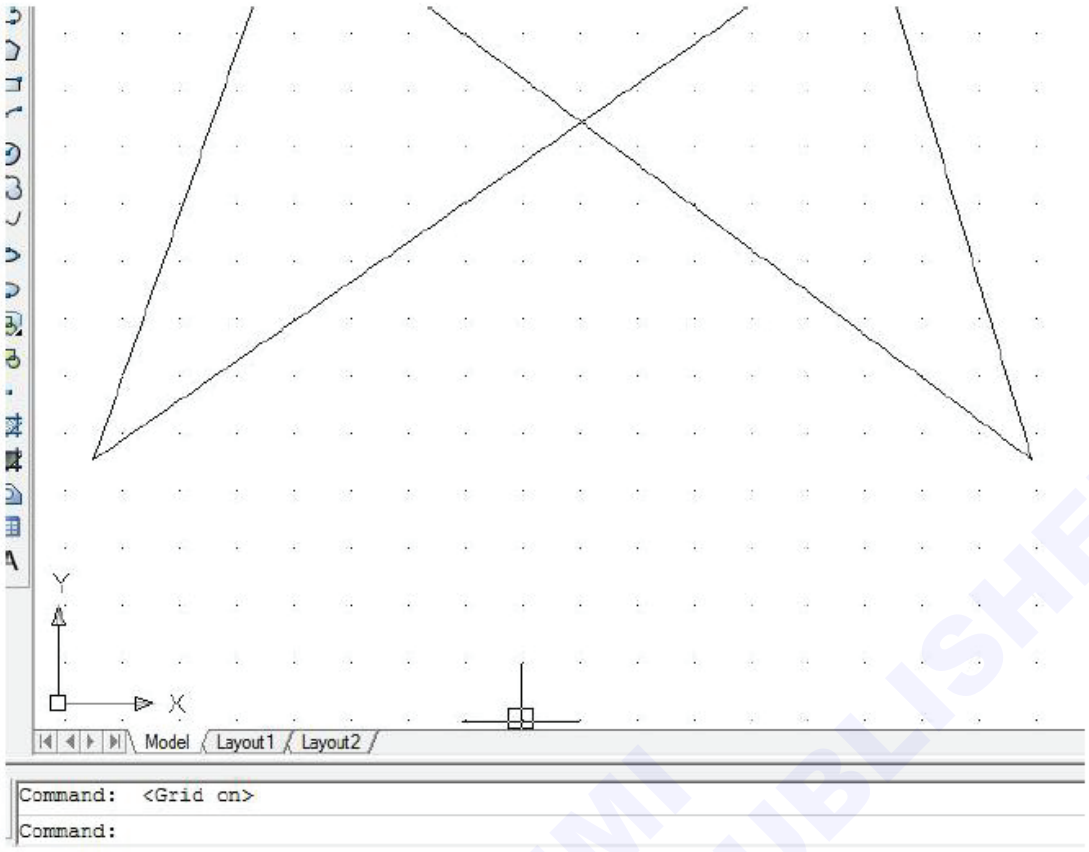
Fig 10



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.

Fig 9



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.

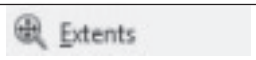
Display commands

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.

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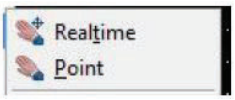
	Allows you to pick a point which will be the center of the zoom area.
	Just click on it zoom in on the drawing. You may preset the amount it zooms in a the command line.
	Just click on it zoom out from the drawing. You may preset the amount it zooms out at the command line.
	This zooms to show the complete electronic page you set up. It zooms out to the electronic sheet limits.
	This will zoom to fit the complete drawing on the screen.
	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.

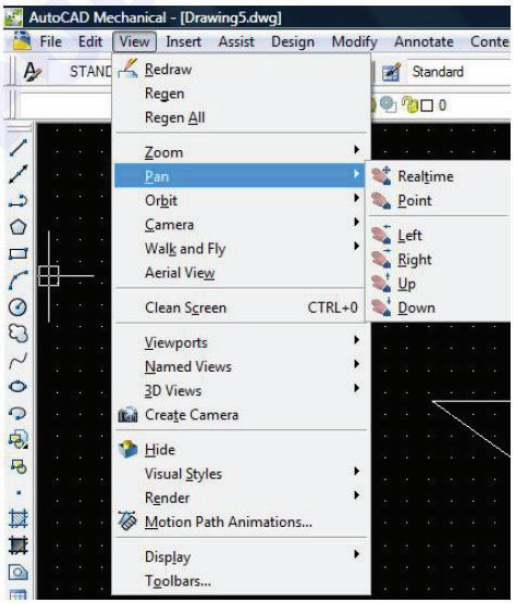
On your own, move the graphic cursor near the upper-right comer inside the drawing area and note that the drawing area is unchanged. (The Drawing Limits command is used to set the drawing area, but the display will not be adjusted until a display command is used.)

Inside the Menu Bar area

Select: **[View] [Zoom] [All] (Figs 11)**

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.

Fig 11



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 are using a video camera.

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Commands and 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.

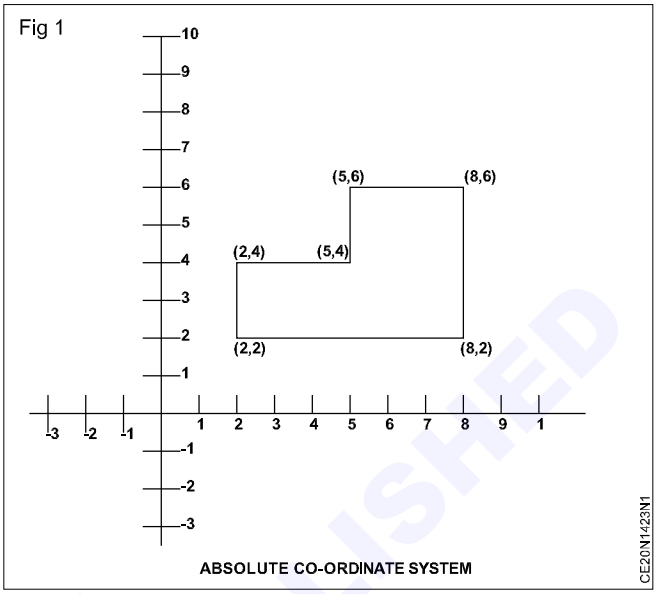
Co-ordinate system in autocad

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

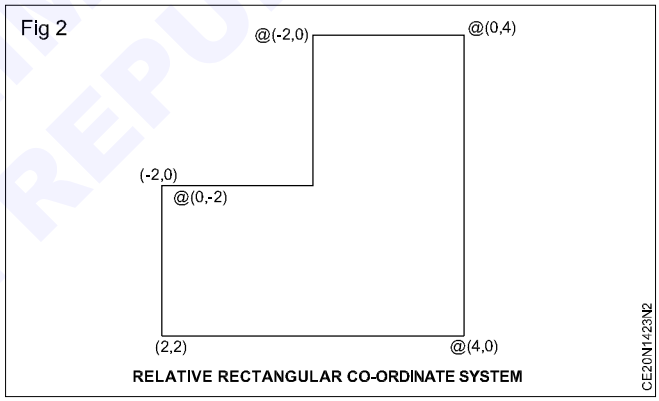
Command _ Line specify first point: 2,2
- Specify next point or [undo]: 8,2
- Specify next point or [undo]: 8,6
- Specify next point or [undo]: 5,6
- Specify next point or [undo]: 5,4
- Specify next point or [undo]: 2,4

Fig 1



Relative rectangular co-ordinate system @ X distance, Y distance (Fig 2)

Fig 2



1 Use relative 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.

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

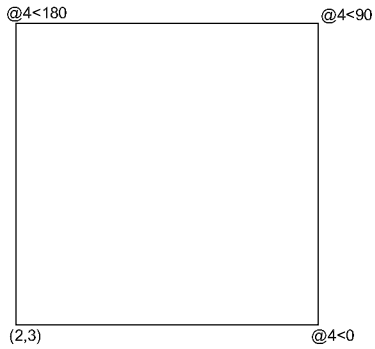
Specify next point or [Close/ undo]: @ c

Relative polar co-ordinate system @ distance angle (Figs 3 & 4)

1 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.

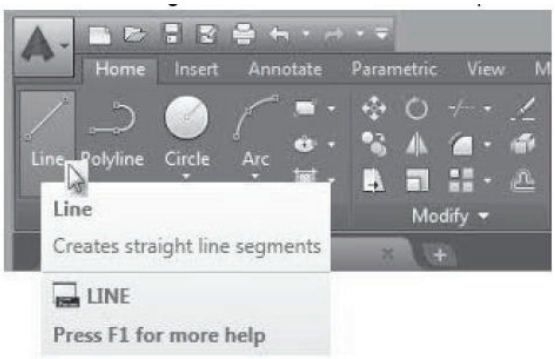
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Fig 3



RELATIVE POLAR CO-ORDINATE SYSTEM

Fig 4



The relative polar co-ordinate is representing in the following format.

@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 (Fig 5 & 6)

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.

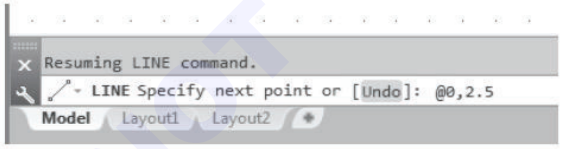
2 Select the icon by clicking once with the **Left - mouse-button,** which will activate the line command.

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.

Fig 5



Fig 6

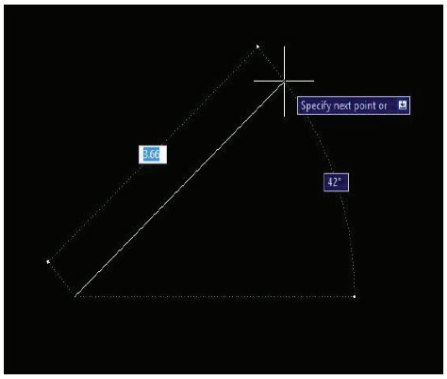


We will create a freehand sketch of a five - point star using the Line command. Do not be overly concerned with the actual size or the accuracy of your freehand sketch.

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.

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. (Fig 7)

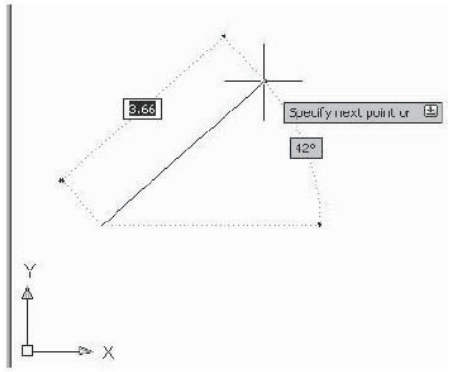
Fig 7



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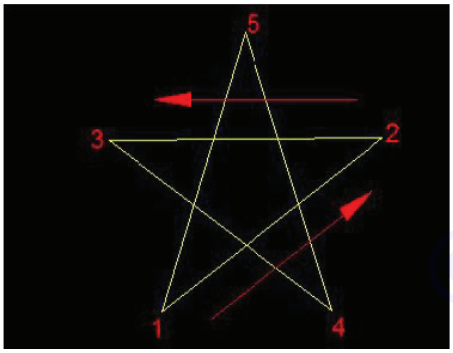
6 Repeat the above steps and complete the freehand sketch by adding three more lines (from point 3 to point 4, point 4 to point 5, and then connect to point 5 back to point 1). (Fig 8)

Fig 8



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. (Fig 9)

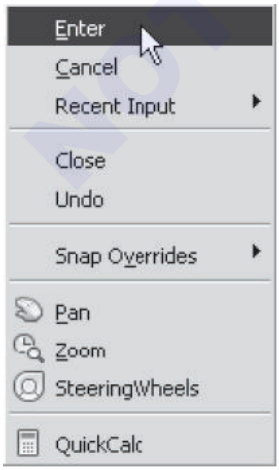
Fig 9



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. (Fig 10)

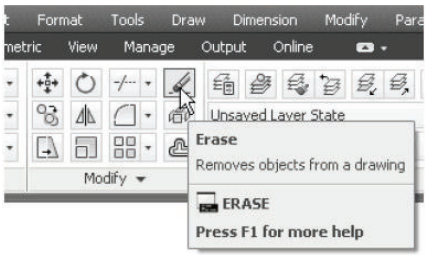
Fig 10



ERASE (Fig 11)

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

Fig 11



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

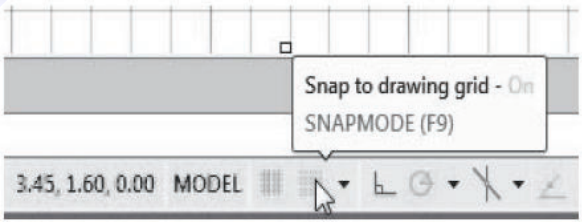
2 Select objects: **Pick one or more objects**

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

METHOD 2

Select the objects first and then the Erase command from the shortcut menu (Fig 12)

Fig 12



1 Select the object (s) to be erased.

2 Press the right mouse button.

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

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.

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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 using 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 area and AutoCAD awaits us to select the objects to erase.

2 Left - click 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 displayed as dashed lines as shown in the figure below.

To deselect an object from the selection set, hold down the [SHIFT] key and 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.

4 Move the cursor towards 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.

5 Inside the graphics window, right-mouse-click once to proceed with erasing the selected entities.

6 When you create a free hand sketch of your choice using the line command. Experiment with using the different commands we have discussed so far, Reset the status button so that only the GRID DISPLAY option is turned ON as shown. (Figs 13 to 16)

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:

Fig 13

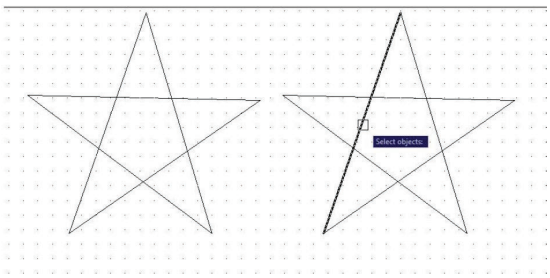


Fig 14

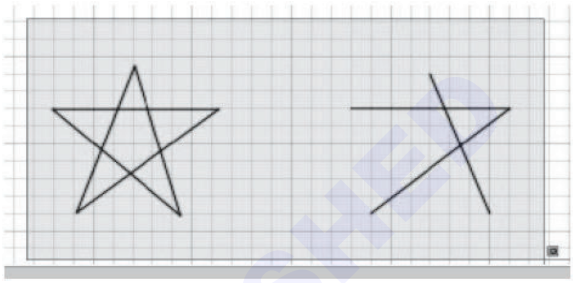
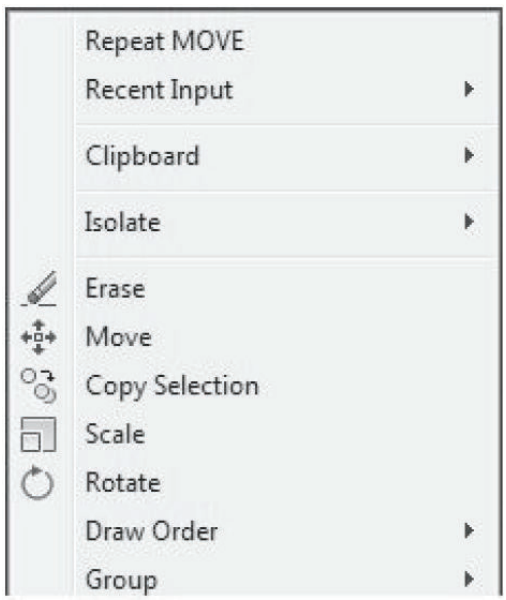


Fig 15



Fig 16



Practice - II (Fig 17)

Instructions

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

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

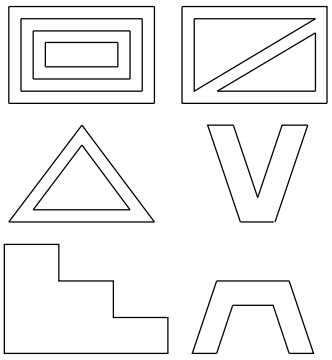
Practice - III (Fig 18)

Instructions

1 Start a **New** file. **(Fig 19)**

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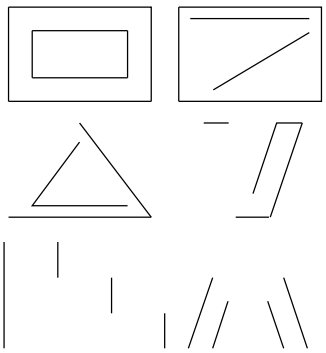
Fig 17



PRACTICE ON LINE COMMANDS

CE20N1423NH

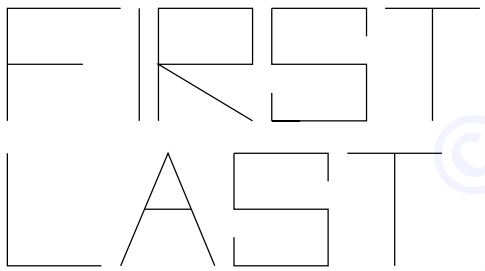
Fig 18



PRACTICE ON ERASE COMMAND

CE20N1423NI

Fig 19



PRACTICE ON LINE & ERASE COMMANDS

CE20N1423NJ

2 **Draw** the objects below using.

Draw / Line.

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

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

Increment Snap (f9) **ON**

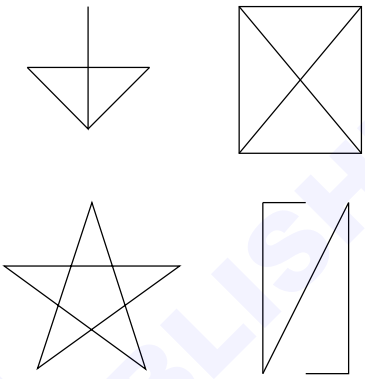
Osnap (f3) **OFF**

3 **Save** this drawing using.

File / Save as DRG NO.

Practice - IV (Fig 20)

Fig 20



PRACTICE ON LINE COMMANDS

CE20N1423NK

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).

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Basic commands - I

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

Creating circles (Fig 1)

The menus and toolbars is **AutoCAD 2013** are designed to allow the CAD operators to quickly activate the desired commands.

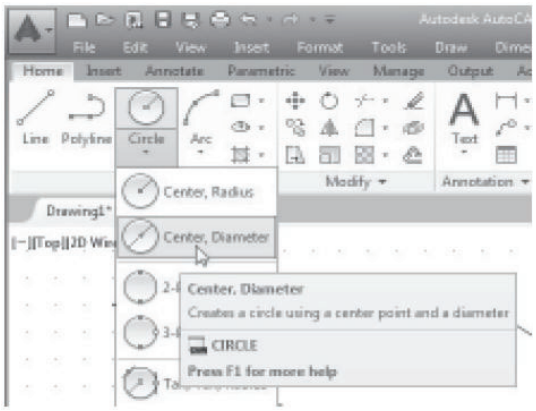
1 In the Draw toolbar, click on the little triangle below the circle icon. Note that the little triangle indicates additional options are available.

2 In the 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.

Fig 1

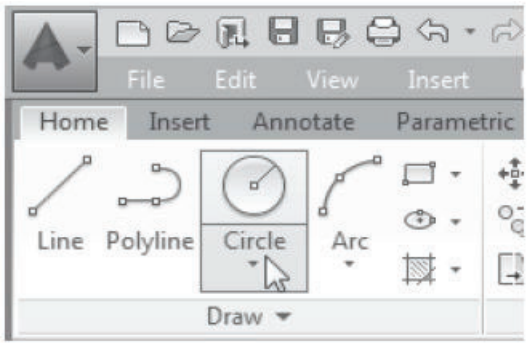


- **Center, diameter:** Draws a circle based on a center point and a diameter.
- **2 points:** Draws a circle based on two.
- **3 Points:** Draws a circle based on three points on the circumference.
- **TTR - Tangent, Tangent, Radius:** Draws a circle with a specified radius tangent to two objects.
- **TTT - Tangent, Tangent, Tangent:** Draws a circle tangent to three objects.

Circle (Fig 2)

AutoCAD provides the following ways of drawing circles.

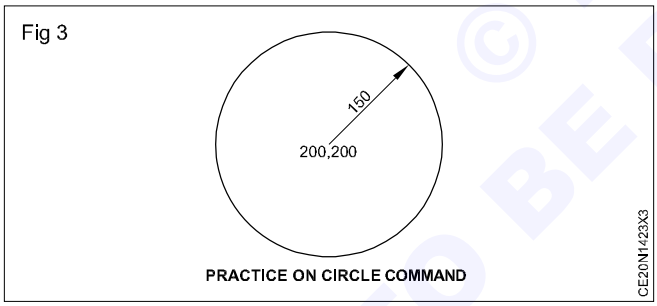
Fig 2



1 Centre and radius (Fig 3)

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

Fig 3



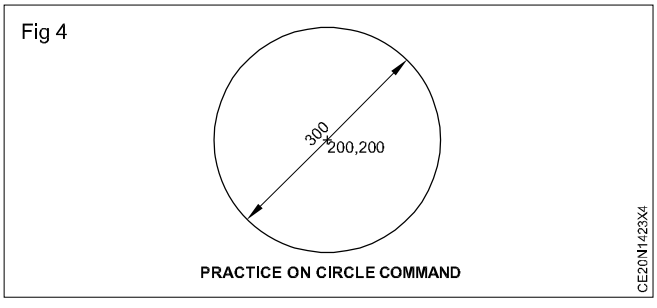
The second one radius

Example

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

2 Centre and diameter (Fig 4)

Fig 4



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

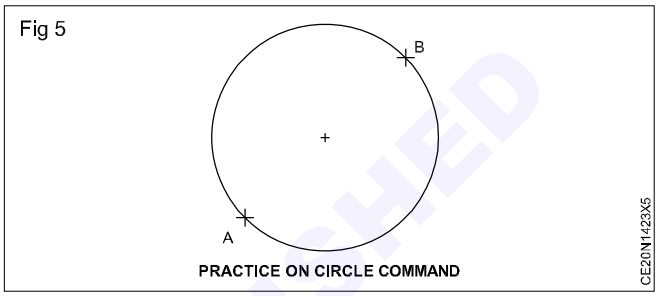
Example

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

3 2 Points (Fig 5)

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

Fig 5



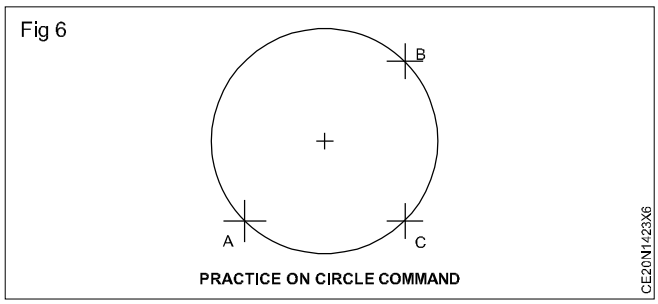
Example

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

4 3 Points (Fig 6)

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

Fig 6



Example

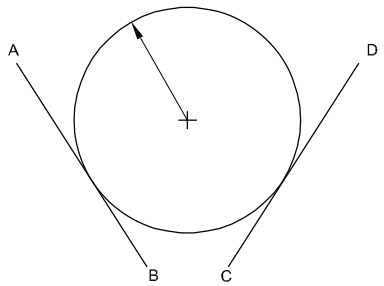
Command	: Circle or C
3P/2P/TTR/<Center point>	: 3P
First point on Diameter	: 200,200
Second point on Diameter	: 400,400
Third point on Diameter	: 300,350

5 Tangent, tangent and radius (Fig 7)

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.

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Fig 7



PRACTICE ON CIRCLE COMMAND

CE20N1423X7

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 provides 11 different ways of drawing Arcs.

1 3 Points (Fig 8&9)

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

2 Start point, centre, end point (S,C,E) (Fig 10)

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 11)

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.

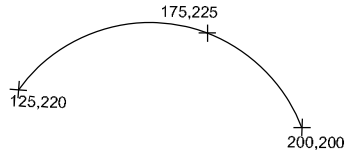
4 Start point centre, length of chord (S,C,L) (Fig 12)

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.

Fig 8



PRACTICE ON ARC COMMAND

CE20N1423X8

Fig 9

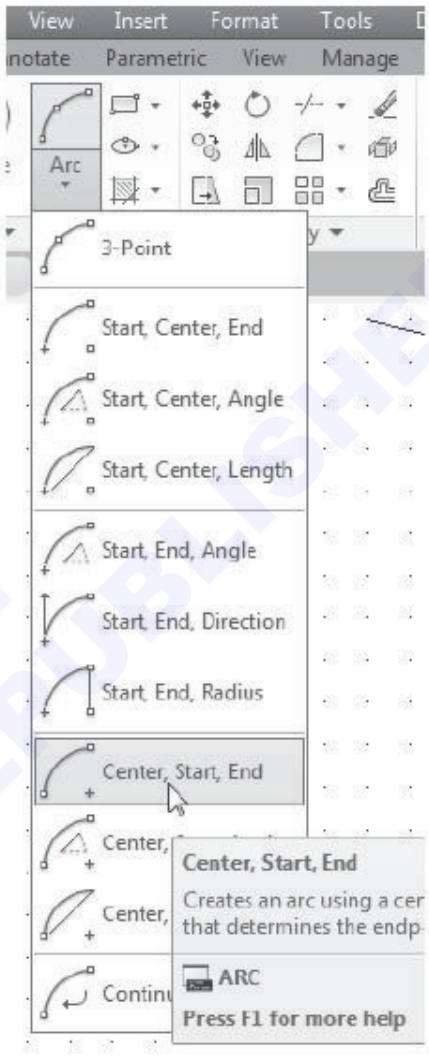
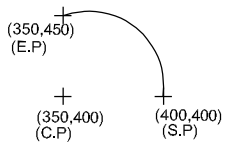


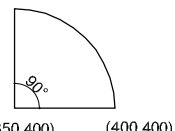
Fig 10



PRACTICE ON ARC COMMAND

CE20N1423XA

Fig 11



PRACTICE ON ARC COMMAND

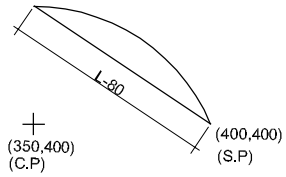
CE20N1423XB

5 Start point, end point, radius (S,E,R) (Fig 13)

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

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Fig 12



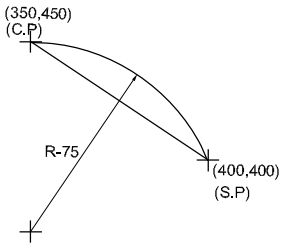
PRACTICE ON ARC COMMAND

CE20N1423XC

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 13



PRACTICE ON ARC COMMAND

CE20N1423XD

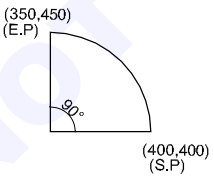
6 Start point, end point, included angle (S,E,A) (Fig 14)

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

Fig 14



PRACTICE ON ARC COMMAND

CE20N1423XE

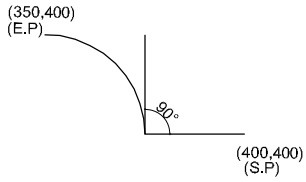
7 Start point, end point, starting direction (S,E,D) (Fig 15)

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 15



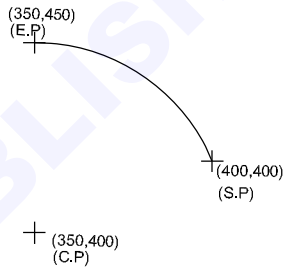
PRACTICE ON LINE COMMANDS

CE20N1423XF

8 Start point, end point, centre point (S,E,C) (Fig 16)

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

Fig 16



PRACTICE ON ARC COMMAND

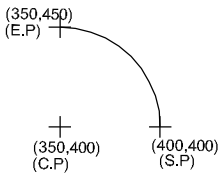
CE20N1423XG

Example

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

9 Centre point, start point, end point (C,S,E) (Fig 17)

Fig 17



PRACTICE ON ARC COMMAND

CE20N1423XH

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

Example

Command	: Arc or A.
Center/<Start point>	: C.
Center point	: 350,400.

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Start point : 400,400.

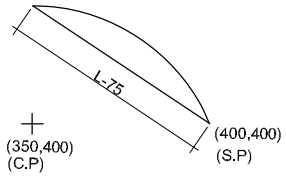
Angle/Length of chord/
<End point> : 350,450.

10 Centre point, start point, length of the chord (C,S,L) (Fig 18)

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

Example

Fig 18



PRACTICE ON ARC COMMAND

CE20N1423XI

Command : Arc or A.

Center/<Start point> : C.

Center point : 350,400.

Start point : 400,400.

Angle/Length of chord/<End point> : L.

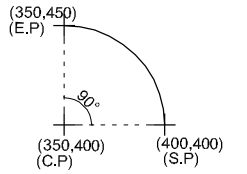
Length of chord : 75.

11 Centre point, start point, included angle (C,S,A) (Fig 19)

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

Example

Fig 19



PRACTICE ON ARC COMMAND

CE20N1423XJ

Command : Arc or A.

Center/<Start point> : C.

Center point : 350,400.

Start point : 400,400.

Angle/Length of chord/<End point> : A.

Included angle : 90.

Ellipse

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

1 Ellipse by axis and eccentricity (Fig 20)

Example

Command : Ellipse or EL.

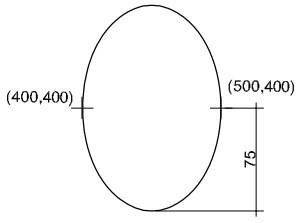
Axis end point of ellipse or (Arc/Center) : 400,400.

Other end point of axis : 500,400.

Distance to other axis or [Rotation] : 75.

2 Ellipse by axis and rotation (Fig 21)

Fig 20

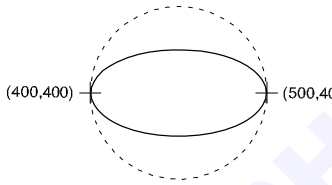


PRACTICE ON ELLIPSE COMMAND

CE20N1423XK

Example

Fig 21



PRACTICE ON ELLIPSE COMMAND

CE20N1423XL

Command : Ellipse or EL.

Axis end point of ellipse or (Arc/center) : 400,400.

Other end point of axis : 500,400.

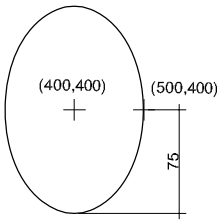
Distance to other axis or [Rotation] : R.

Rotation around major axis : 60.

3 Ellipse by centre and two axes (Fig 22)

Example

Fig 22



PRACTICE ON ELLIPSE COMMAND

CE20N1423XM

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.

4 Ellipse by centre, one axis, and rotation (Fig 23)

Example

Command : Ellipse or EL.

Axis end point of ellipse or (Arc/center) : C.

Center of ellipse : 400,400.

Axis end point : 500,400.

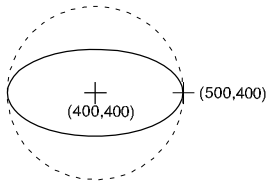
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Distance to other axis or [Rotation] : R.

Rotation around major axis : 60.

Polygon

Fig 23



PRACTICE ON ELLIPSE COMMAND

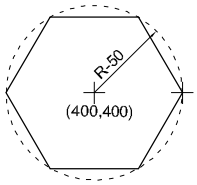
CE20N1423XN

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

1 Centre of polygon, inscribed circle, radius (Fig 24)

Example

Fig 24



PRACTICE ON POLYGON COMMAND

CE20N1423XO

Command : POL.

POLYGON Enter number of sides : 6.

<default>

Center of polygon or [Edge] : 400,400.

[Inscribed in circle/

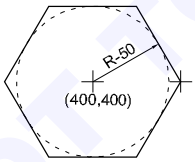
Circumscribed about circle]<I> : I.

Specify radius of circle : 50.

2 Centre of polygon, circumscribed about circle radius of circle (Fig 25)

Example

Fig 25



PRACTICE ON POLYGON COMMAND

CE20N1423XP

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.

3 Edge option (Fig 26)

Example

Command : Polygon/POL

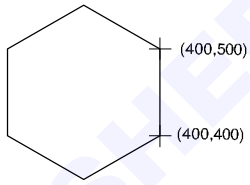
POLYGON Enter number of sides <default> : 6.

Center of polygon or [Edge] : E.

First end point of edge : 400,400.

Second end point of edge : 400,500.

Fig 26



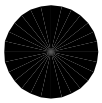
PRACTICE ON POLYGON COMMAND

CE20N1423XQ

Doughnut (Donut) (Fig 27)

This command allows the user to draw filled circles and rings

Fig 27



PRACTICE ON DOUGHNUT COMMAND

CE20N1423XR

Example of filled circle option

Command : Donut.

Inside diameter <default> : 0.

Out side diameter <default> : 50.

Center of doughnut : 100,100.

Example for rings (Fig 28)

Fig 28



PRACTICE ON DOUGHNUT COMMAND

CE20N1423XS

Command : Donut.

Inside diameter <default> : 30.

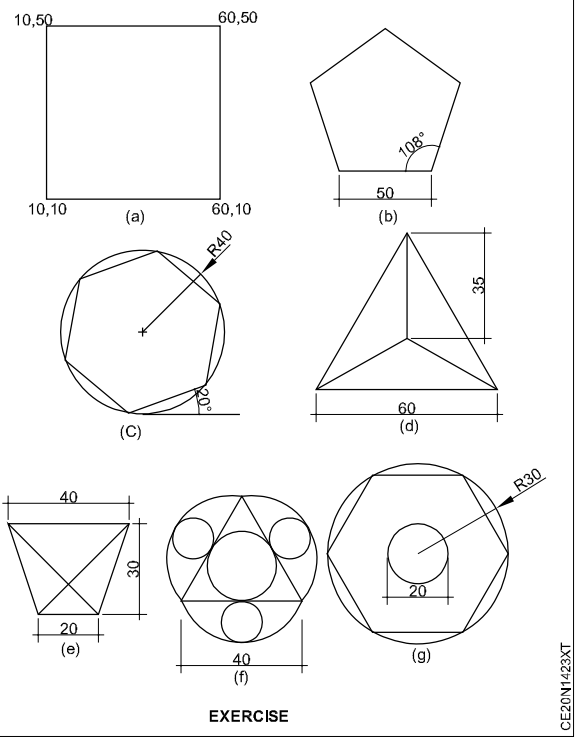
Out side diameter <default> : 50.

Center of doughnut : 100,100.

Draw the following exercise (Fig 29)

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Fig 29



Basic commands - II

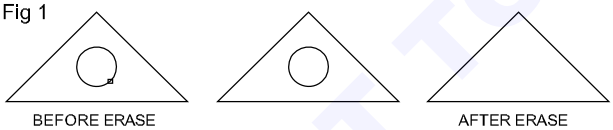
Objectives : At the end of this exercise you shall be able to
- **erase, oops, move, copy, offset, rotate**
- **scale, fillet, trim, chamfer, extend, break**
- **join, mirror, array, stretch, lengthen, explode.**

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)

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.

Tool bar : Modify, Erase.

Pull down : Modify, Erase.

Command : Erase./ E.

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

Fig 2



Example

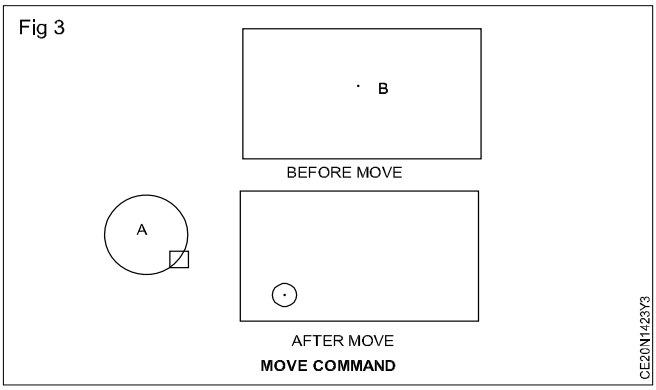
Command : Erase or E

Select objects : Select the objects using mouse

Command : Oops

3 Move (Fig 3)

Fig 3



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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.

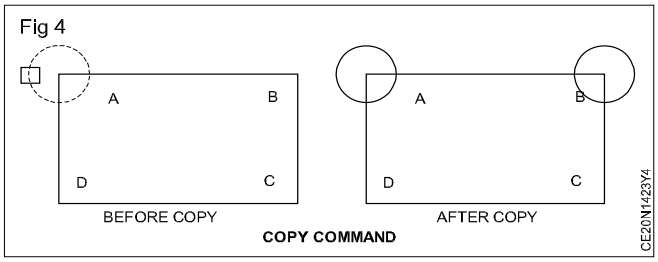
Select objects : One found.

Select objects :

Base point or displacement : Click A as basepoint.

Second point of displacement : Select B.

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

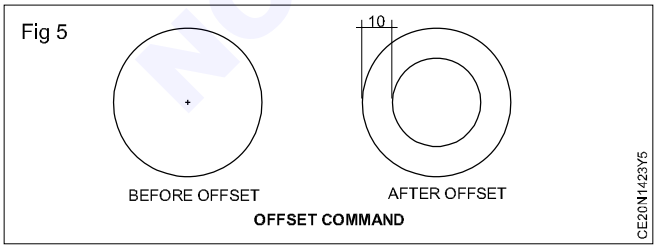
Select objects : Select object to Copy

Select objects : One found

Base point or displacement : Select a base point.

Second point of displacement : Drag cursor at desired place and click mouse.

5 Offset (Fig 5)



Tool bar : Modify, Offset.

Pull down : Modify, Offset.

Command : Offset / O.

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.

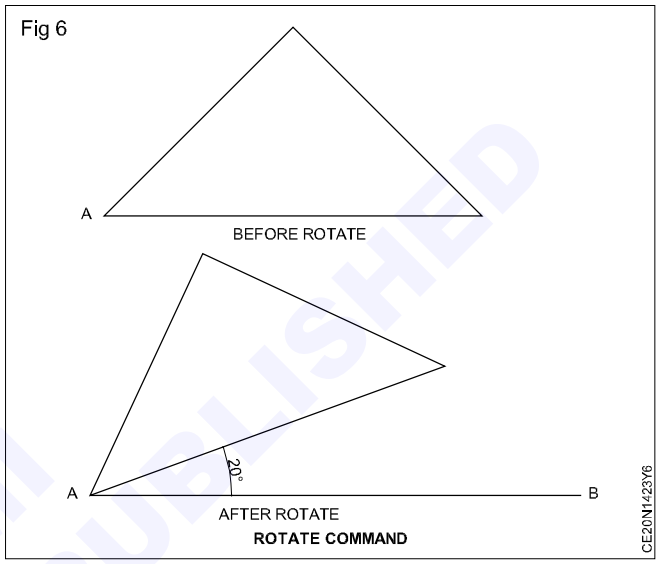
Command : Offset or O.

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.

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

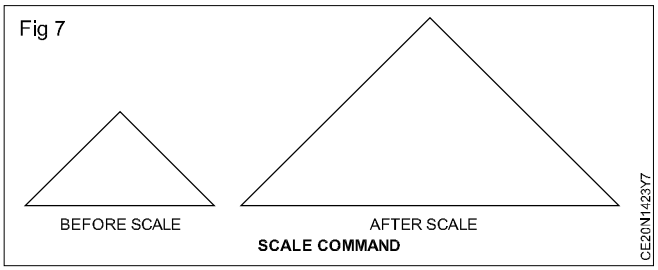
Select objects : Select the object by window.

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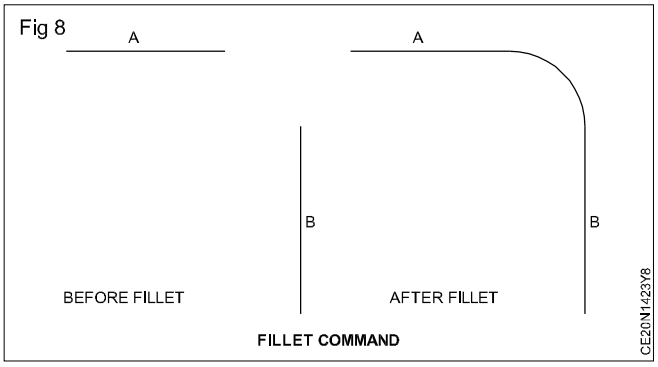
Select objects : Three found.

Select objects :

Specify scale factor or [Copy/Reference]<Default> : 2.



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

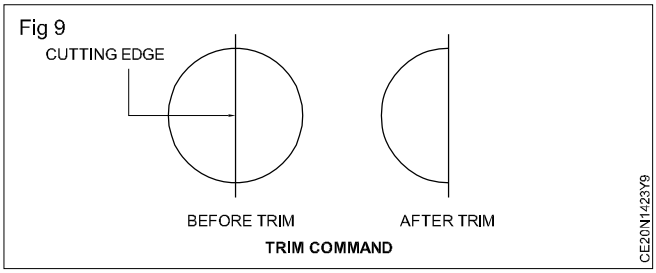
Specify fillet radius<0.0000>

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

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

9 Trim (Fig 9)

This command is used to remove 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:

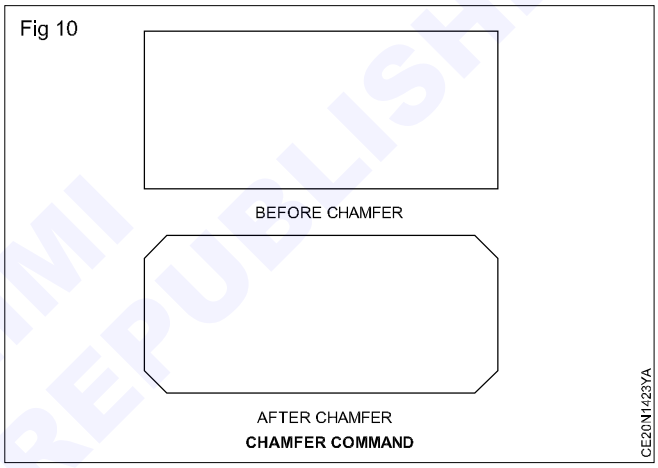
Select object to trim of shift - select to extend or

[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 inter setting 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>.

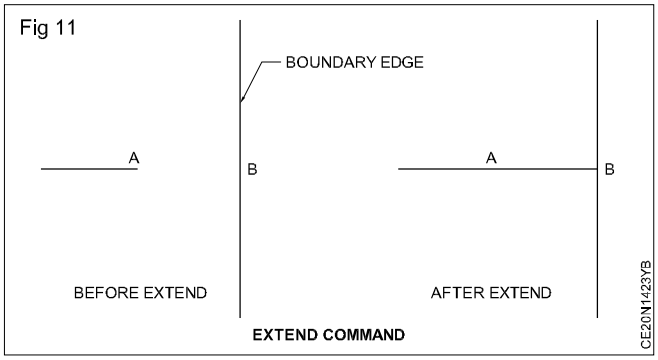
Select first line:

Select second line:

11 Extend (Fig 11)

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

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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]:

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.

13 Join (Fig 13)



This command is used to join two lines.

Tool bar : Modify, Join.

Pull down : Modify, Join.

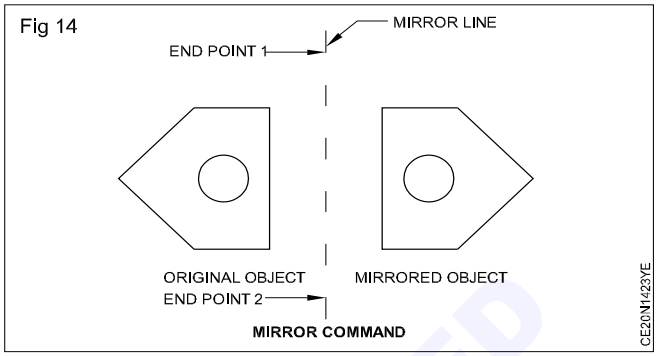
Command : Join or J.

Example

Command : Join or J. Select source object.

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

14 Mirror (Fig 14)



Tool bar : Modify, Mirror.

Pull down : Modify, Mirror.

Command : Mirror or MI.

This command is used to create a mirror 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.

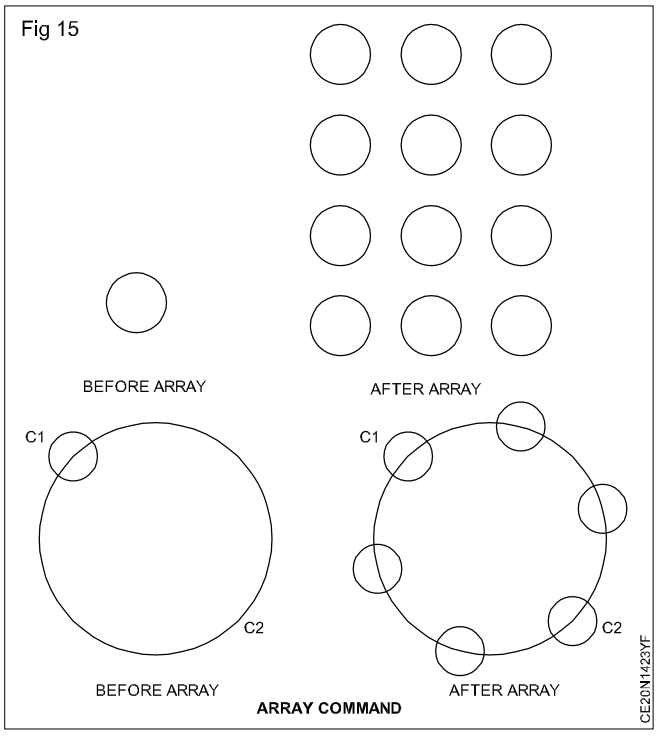
Select object :

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.

15 Array (Fig 15)



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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 polar (circular) 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 Array (R/P) : P.

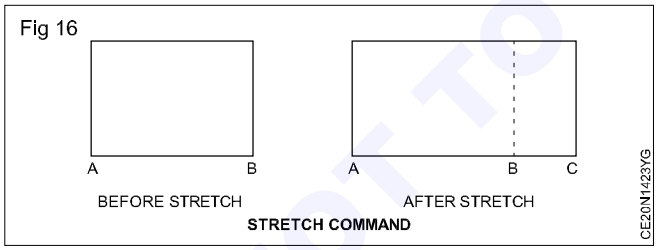
Base /<Centre point of Array> : Select circle C2.

Number or Items : 4.

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

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

16 Stretch (Fig 16)



Tool bar : Modify, Stretch.

Pull down : Modify, Stretch.

Command : Stretch or S.

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

Example : 1

Command : STRETCH.

Select objects to stretch by crossing - window

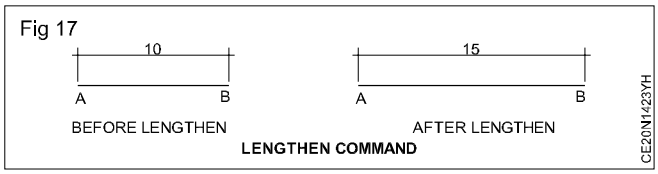
Select objects : Select A and B by crossing - window.

Select objects :

Specify base point or [Displacement] <Displacement>.

Specify second point: Mouse click at C.

17 Lengthen (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

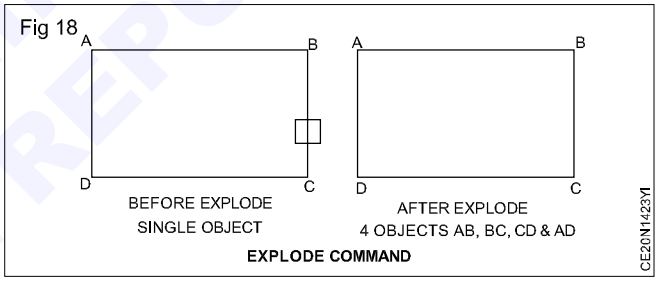
(Current length: 10).

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]

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 polyline the result will be ordinary lines or arcs.

Example : 1

Command : EXPLODE or X.

Select an object : Select the rectangle.

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).

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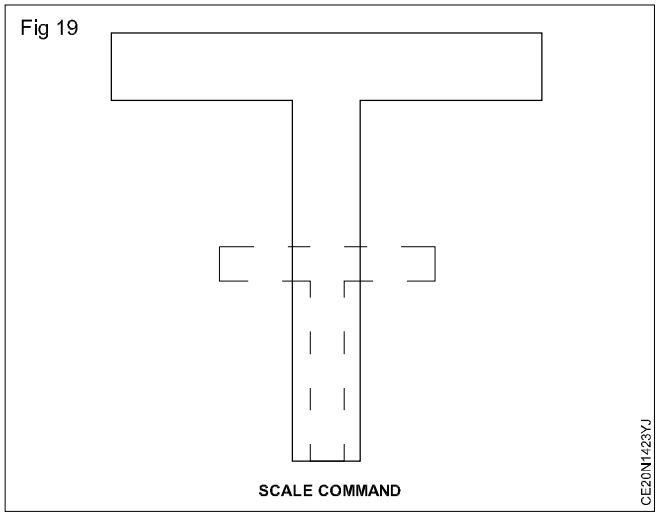
Type — A rotation angle <Scale factor> / Reference: (number).

or

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

Scale factor / Reference: (points).

Fig 19



Scale by specifying length

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)

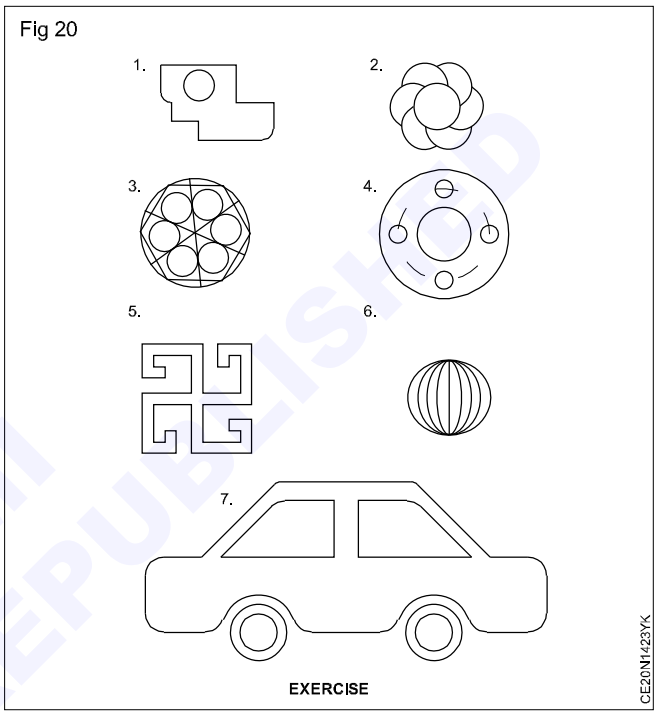
3 Choose — A new scale factor.

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



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Creation of object in different layers on CAD workspace

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

PROCEDURE

TASK 1: **Printing a drawing by using key board**

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

Print or plot command

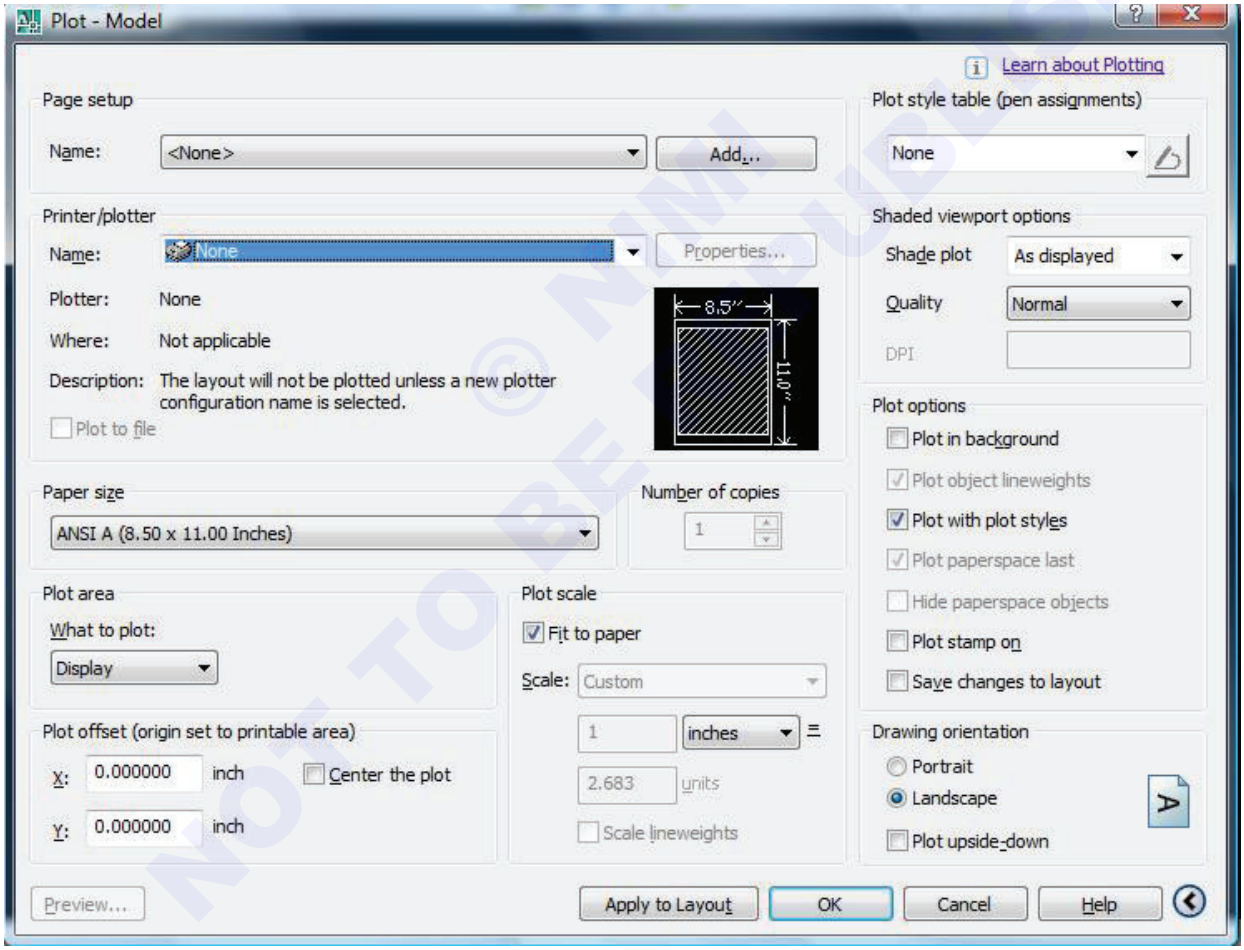
- Various input facilities are available for printing a drawing. Facilities like key board, menu bar or tool bar with mouse are explained below.

Printing a drawing by using key board (Fig 1)

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

Fig 1



— — — — — — — —

TASK 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.

— — — — — — — —

TASK 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
- **explain about layers**.

TASK 1: **Setting up a layer**

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. (Fig 1)

Setting up a new layer (Fig 2)

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

click on line weight

click on apply m click on ok on the layer properties manager dialogue box (Fig 3).

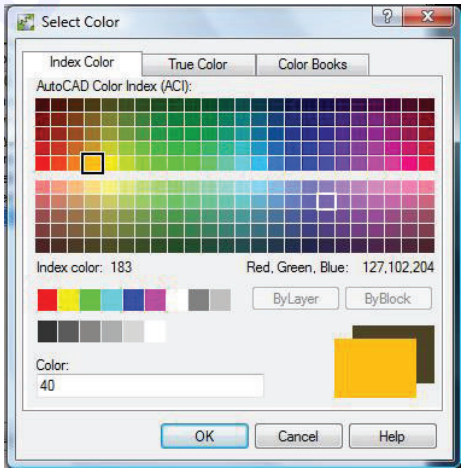
Making a layer current

A layer must be current before you can draw on it. To make the layer (hatch) current, carryout the following easy steps (Figs 4 to 7)

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.

Fig 1



click ok

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

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.

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

Click on the drawing editor any where

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In the layer properties dialogue box, click on new

Fig 2

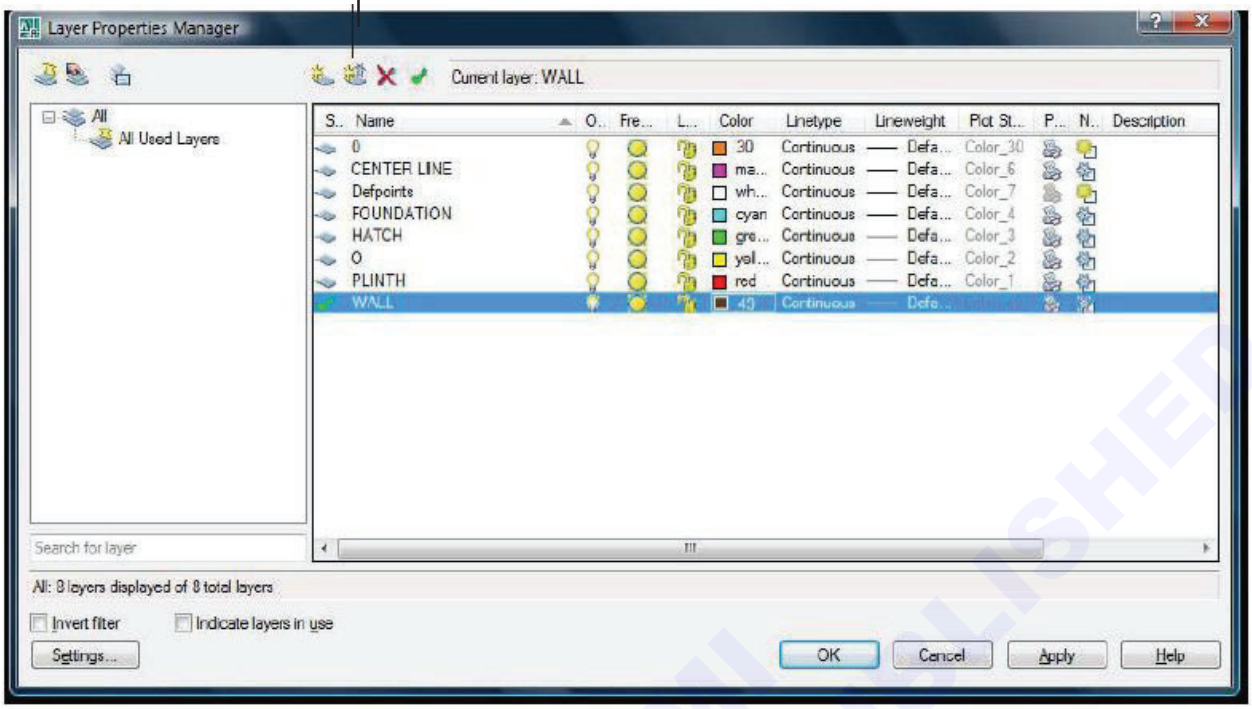
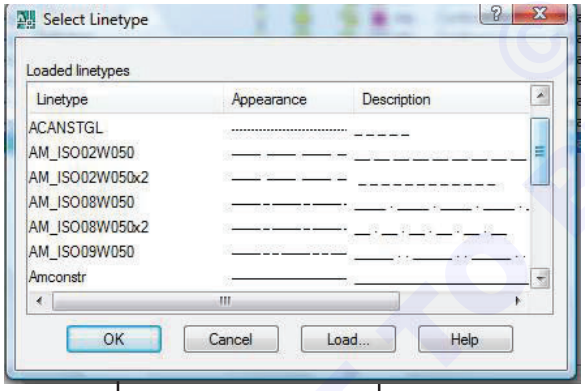


Fig 3



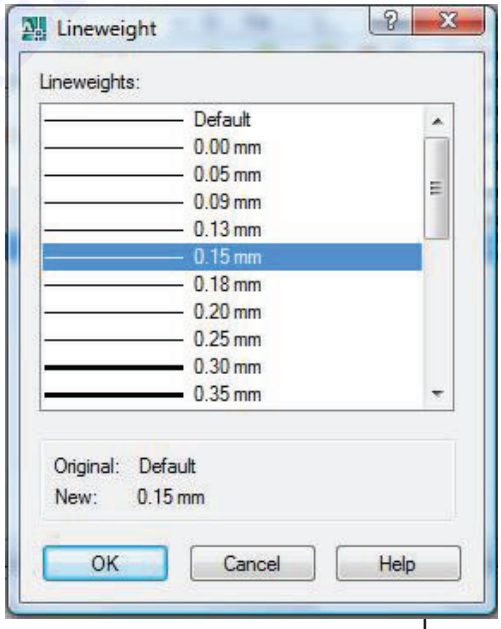
Click on

line type

click ok

select line type

Fig 4



click ok

select line weight

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Fig 5

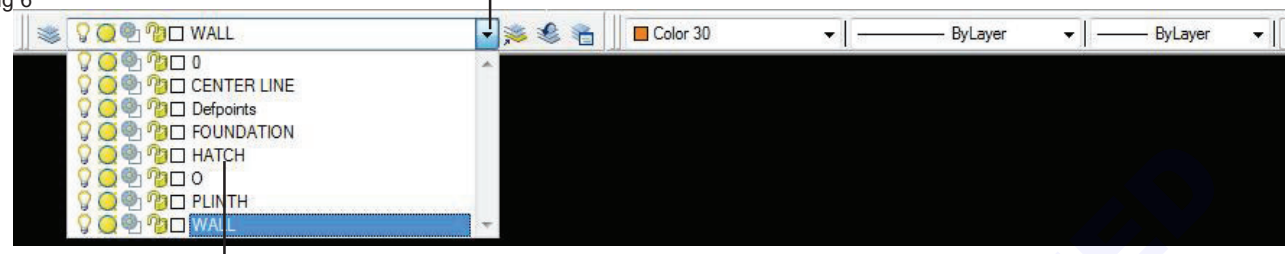


layers icon

current layer and color

Click here

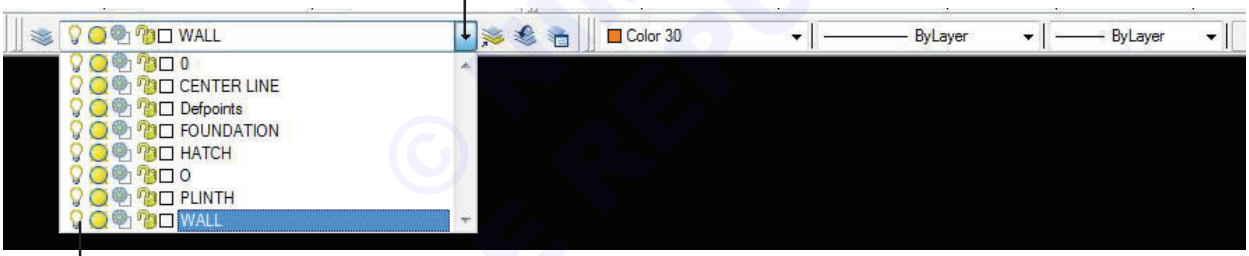
Fig 6



Click here near the layer name

Click here

Fig 7



Click here on the light bulb

TASK 2: **Making layer visible or invisible**

- Complex drawings may become cluttered, which 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.

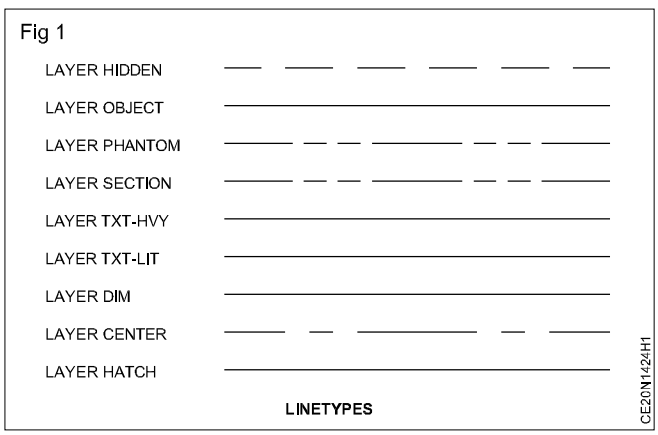
Clickout on the drawing editor anywhere.

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

Fig 1



2 Draw the LINES below using:

Draw / Line

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

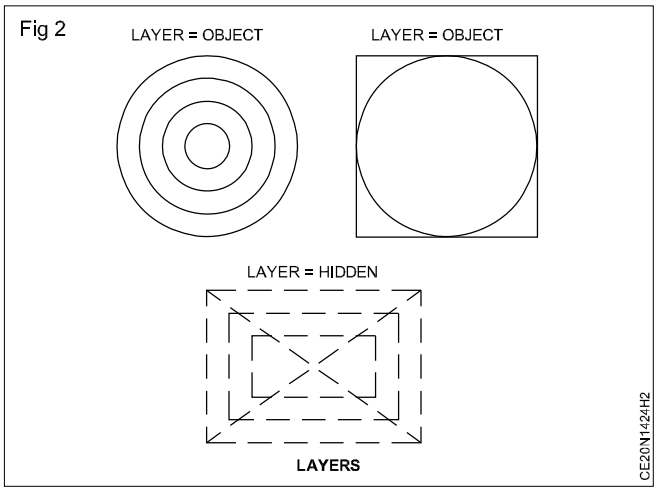
Increment snap (f 9) ON

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)



1 Start a New file and select 1 workbook dwt

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

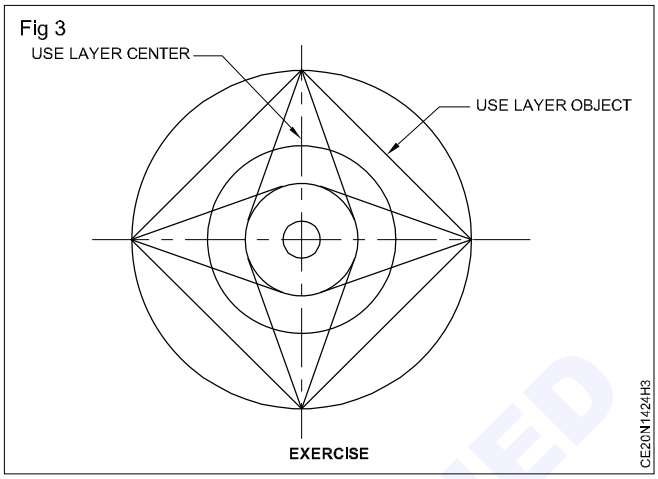
Using: TOOLS/DRAFTING SETTINGS

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

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)

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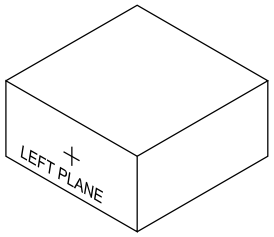
Plotting of drawing from CAD

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

PROCEDURE

TASK 1: **ISO metric drawing (Fig 1)**

Fig 1



LEFT
ISOMETRIC DRAWING

CE20N1425H1

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

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 snap.

3 Click OK.

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

5 Command: Isoplane (or Isoplane for transparent use)

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

7 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.

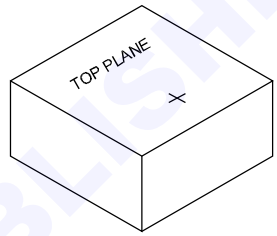
8 The current isometric plane also determines the orientation of isometric circles drawn by “ELLIPSE”. You can cycle through the isometric planes by pressing CTRL+ E or F5.

Left

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

2 **Top (Fig 2)**

Fig 2



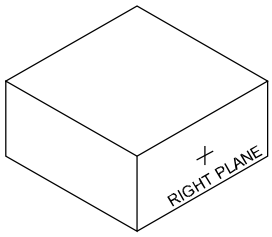
TOP
ISOMETRIC DRAWING

CE20N1425H2

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

3 **Right (Fig 3)**

Fig 3



RIGHT PLANE
ISOMETRIC DRAWING

CE20N1425H3

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

2 When the snap style has been set to isometric, you will find iso circle. Option under ellipse command. Use this to draw circle and arcs in isometric plane.

— — — — — — — —

TASK 2: **Create the isometric drawing shown in the Fig 1**

Step 1

1 Change the isometric view by using snap command.

2 Command: snap

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

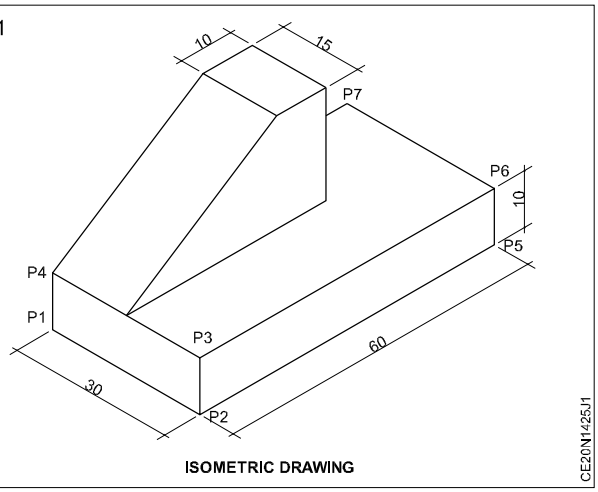
4 Specify vertical spacing <0.5000>.

Step 2

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

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Fig 1



ISOMETRIC DRAWING

Step 3

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

Step 4

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

Step 5

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

Dimensioning and text

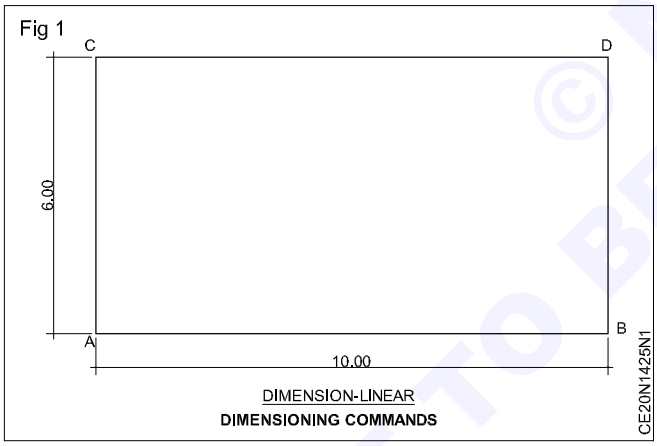
Objectives : At the end of this exercise you shall be able to
- **explaining about dimensioning**
- **explaining about text and text style.**

TASK 1: **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)

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

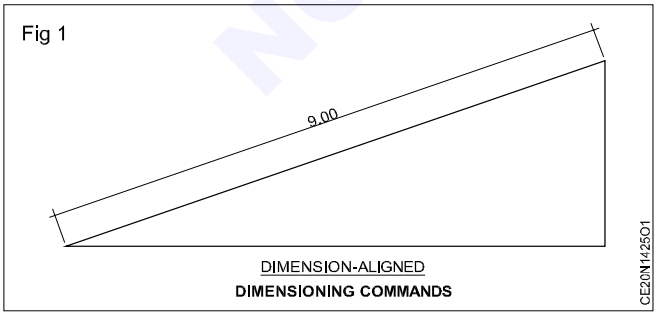
Example

- 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

— — — — — — — —

TASK 2: **Dimension - aligned (Fig 1)**

Fig 1



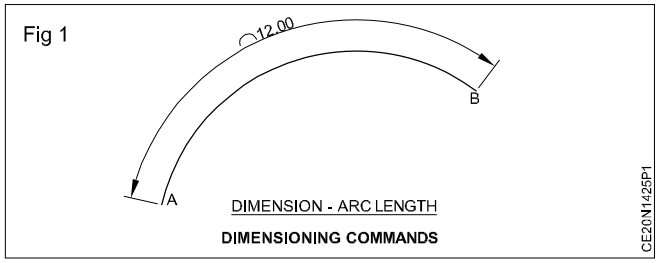
1 This command is used to measure inclined dimension between two points.
- Tool bar : Dimension, Aligned
- Pull down: Dimension, Aligned
- Command: DIM ALI /DAL

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

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TASK 3: **Dimension - ARC length (Fig 1)**



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

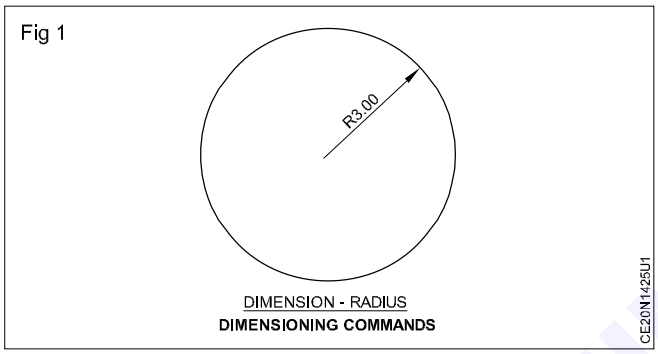
- Tool bar : Dimension, Arc length
- Pull Down: Dimension, Arc length
- Command :DIMARC/DAR

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

— — — — — — — —

TASK 4: **Dimension - radius (Fig 1)**



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

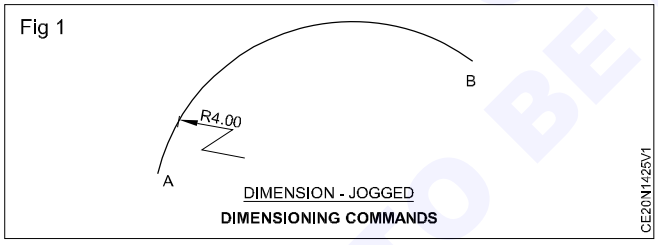
- Tool bar : Dimension, Radius
- Pull Down: Dimension, Radius
- Command: DIM RA/DRA

Example

- Command : DIM RA / DRA
- Select arc or
- circle : Select the circle
- Dimension text = 3.00
- Specify dimension line location or [Mtext /Text/Angle]

— — — — — — — —

TASK 5: **Dimension - jogged (Fig 1)**



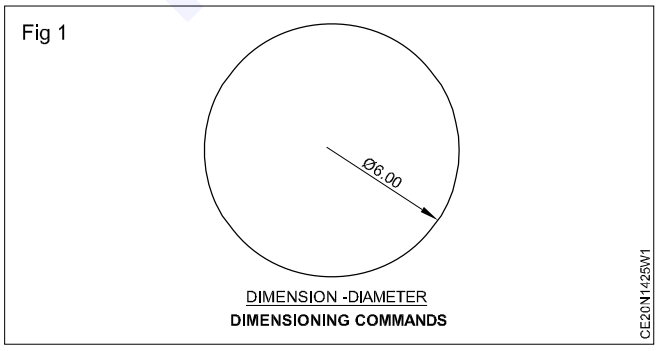
- Tool bar : Dimension, Jogged
- Pull Down : Dimension, Jogged
- Command : DIM JO/DJO

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.

— — — — — — — —

TASK 6: **Dimension - diameter (Fig 1)**



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

- Tool bar : Dimension, Diameter
- Pull Down : Dimension, Diameter
- Command : DIM DIA/DDI

Example

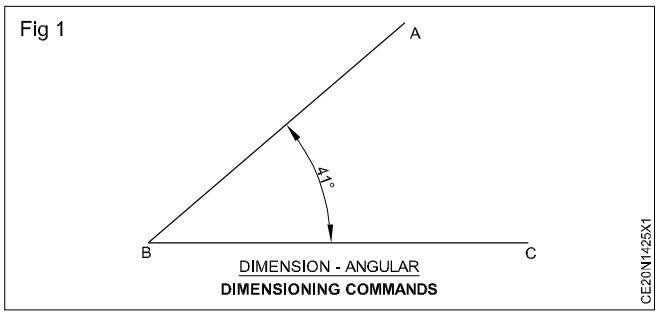
- Command : DIM DIA/DDI
- Select arc

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- 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.

TASK 7: **Dimension - Angular (Fig 1)**

Fig 1



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

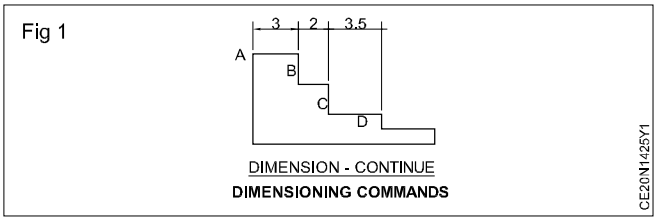
- Tool bar : Dimension, Angular
- Pull Down : Dimension, Angular
- Command : DIM ANG/DAN

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

TASK 8: **Dimension - continue (Fig 1)**

Fig 1



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

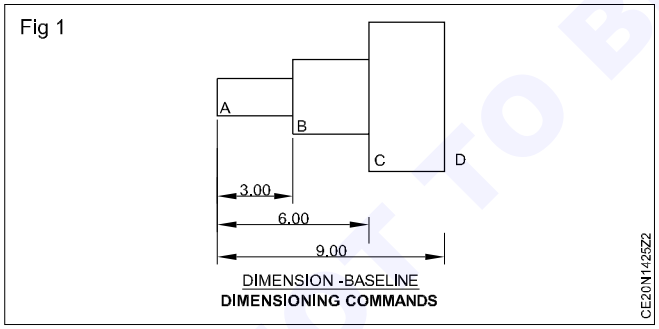
- Tool bar : Dimension, Continue
- Pull Down : Dimension, Continue
- Command : DIM CON/DCO

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

TASK 9: **Dimension - base line (Fig 1)**

Fig 1



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

- 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

TASK 10: **Dimension - leader (Fig 1)**

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

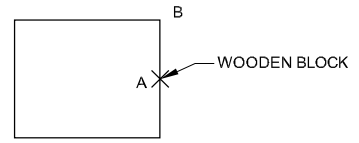
- Tool bar : Dimension Leader
- Pull Down : Dimension Leader
- Command : DIM LEA/LE

Example

- Command : DIM LEA/LE
- Specify first leader point, Select point A

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Fig 1



DIMENSION - LEADER
DIMENSIONING COMMAND

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- Specify next point: Select point B
- Specify next point
- Specify text width <0.0000>
- Enter first line of annotation text <Mitest> WOODEN BLOCK

TASK 11: **Dimension - style (Fig 1 & 2)**

Fig 1

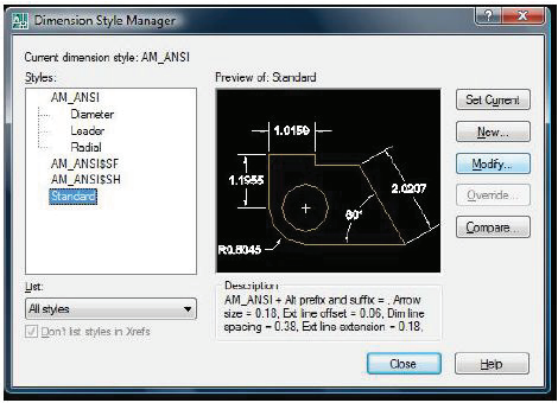
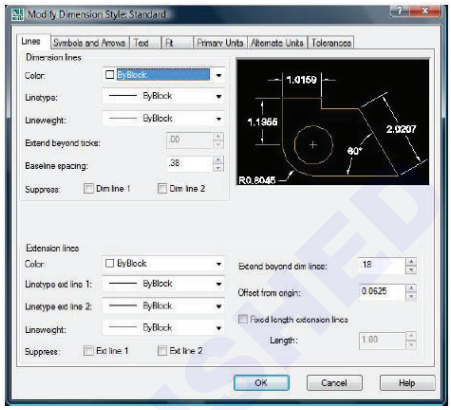


Fig 2

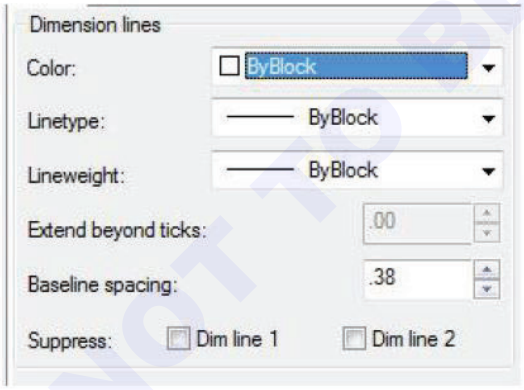


1 Pull down menu: Dimension, Dimension style

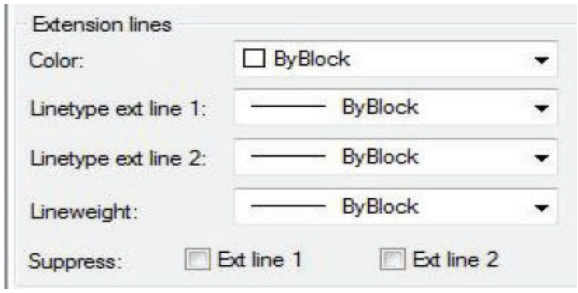
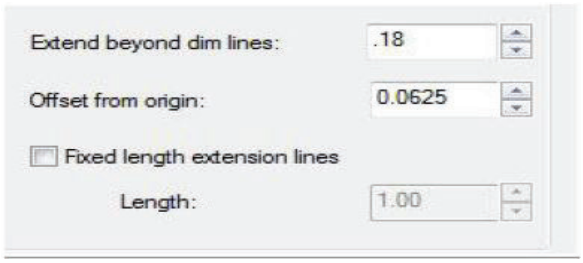
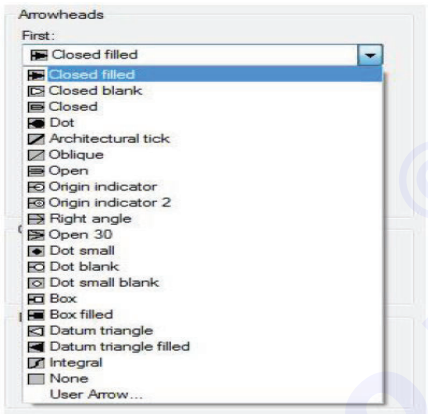
2 When you select this, a dimension style manager dialogue box will appear on the screen.

3 A dimension style is a saved set of dimension settings defining the appearance and behaviour of the dimensions.

4 By creating dimension styles. You can set all relevant dimension system variables and control the layout and appearance of all dimensions within a drawing.

Description	
Fig 3 	Sets the dimension line properties (Fig 3) 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.

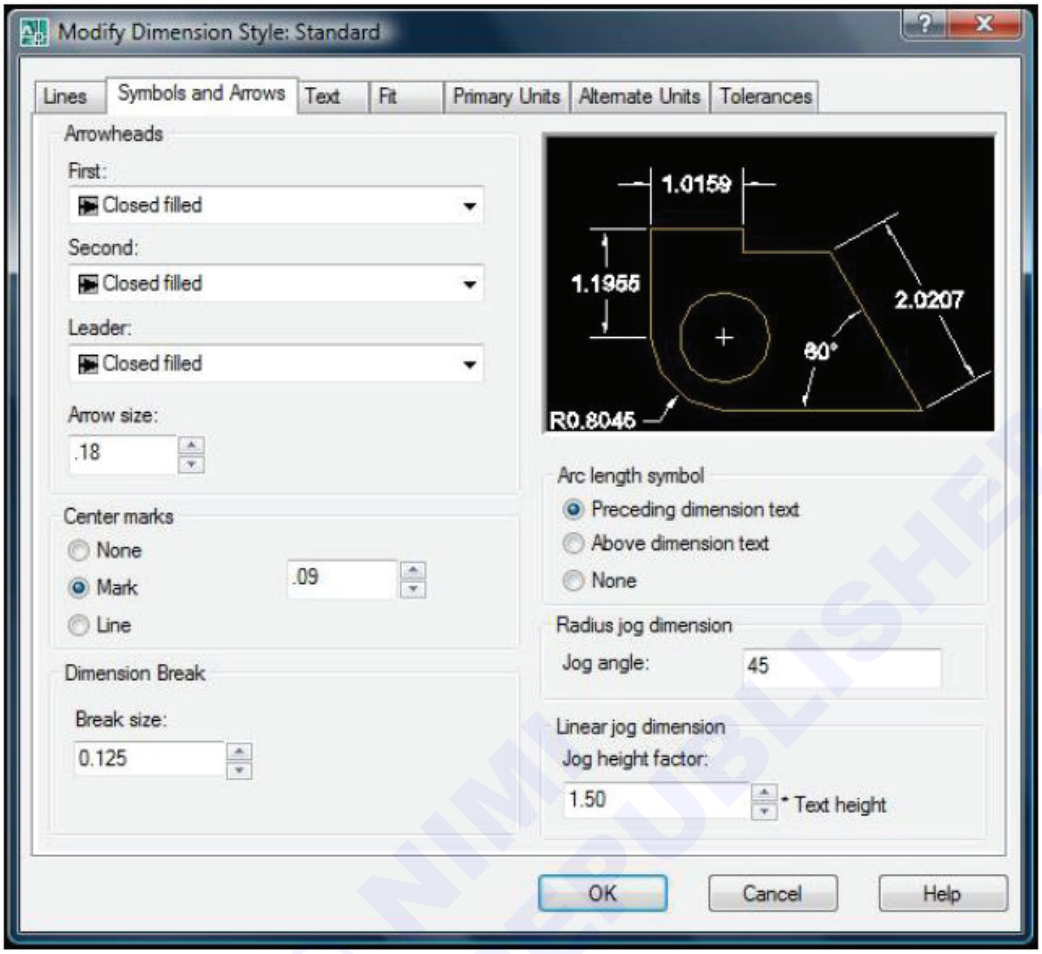
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Description	
Fig 4  	Set the extension line properties (Fig 4) 1 Colour displayed and sets the colour for extension line. 2 Line type sets the type of the extension lines. 3 Line weight sets the line weight of the extension lines. 4 Suppress suppresses display of extension lines.
Fig 5  	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. (Fig 5)
Fig 6  	1 Here you can set the types of arrow heads. 2 Arrow size sets the size of arrow. (Fig 6)

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Symbols and arrows tab (Fig 7)

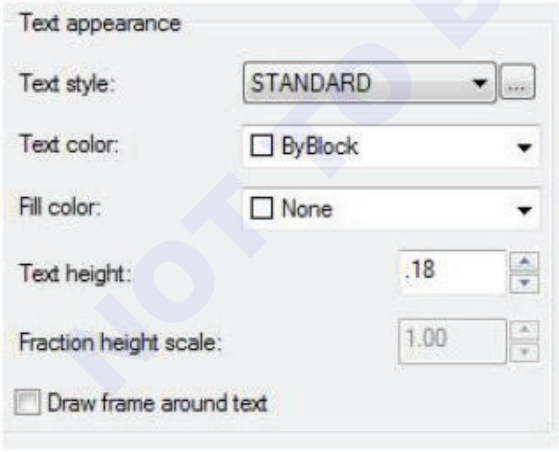
Fig 7



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Description

Fig 8



1 Text style button displays the text style dialogue box, which you can use to define or modify text styles.

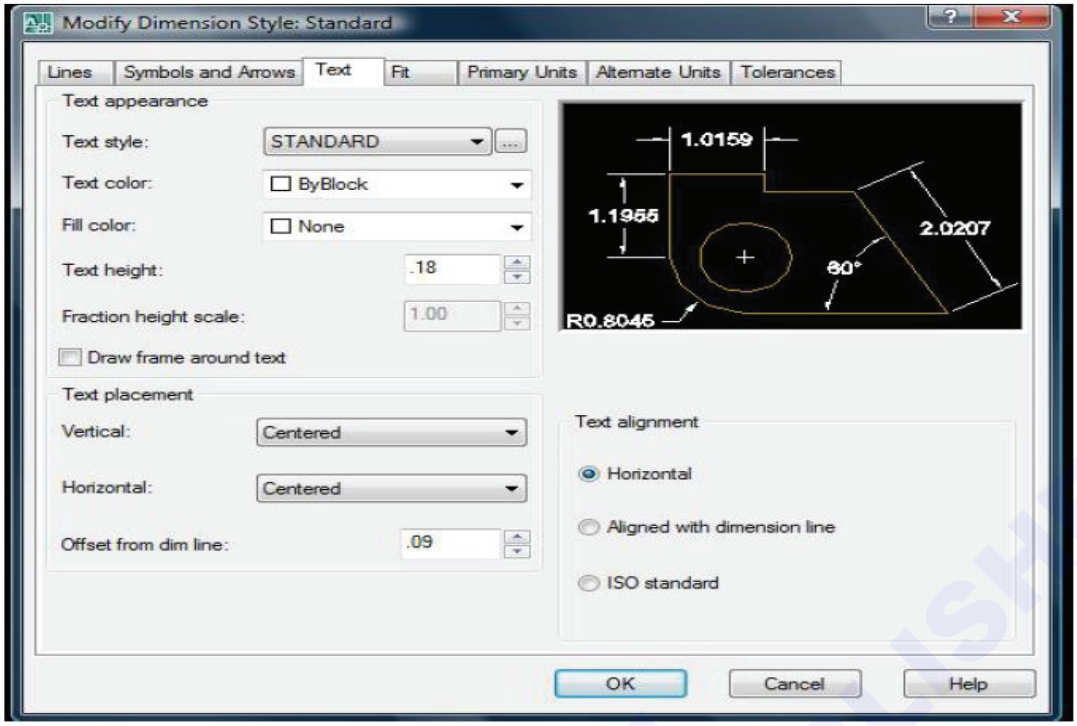
2 Text colour displays and sets the colour for the dimension text.

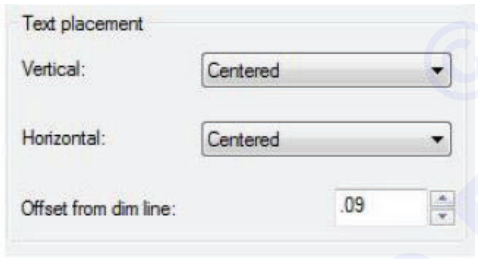
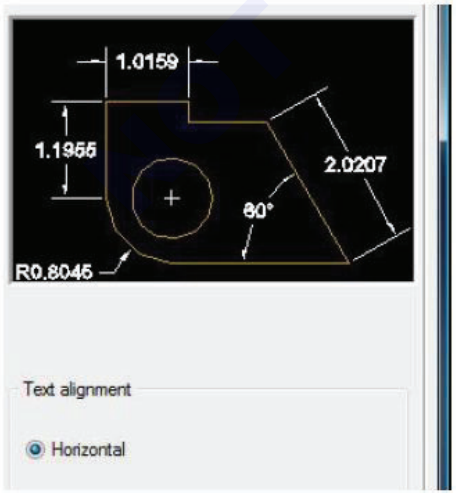
3 Text height displays and sets the current dimension text style.

4 Draw frame around text draws a frame around dimension text. (Fig 8)

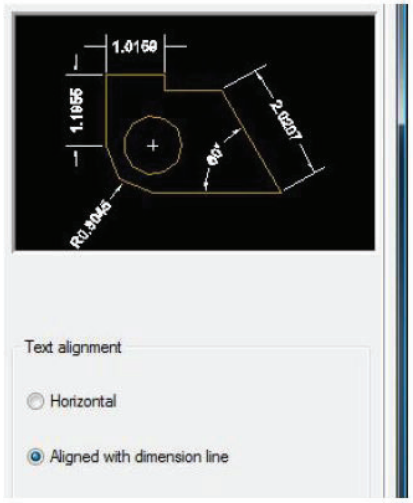
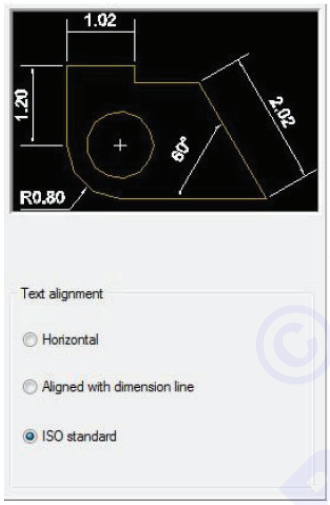
Text tab (Fig 9)

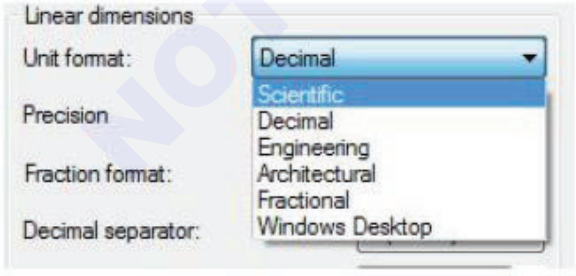
Fig 9



Description	
Fig 10  	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. (Fig 10)
Fig 11  	1 Horizontal places text in a horizontal position. (Fig 11)

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Description	
Fig 12  	2 Aligned with dimension line aligns text with the dimension line. (Fig 12)
Fig 13  	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. (Fig 13)

Primary units tab	
Fig 14  	**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.

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Fig 15



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.

1 Single line text or D text.

2 Multiline text or M text.

— — — — — — — —

TASK 12: **Single line text or D text and Multi line 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

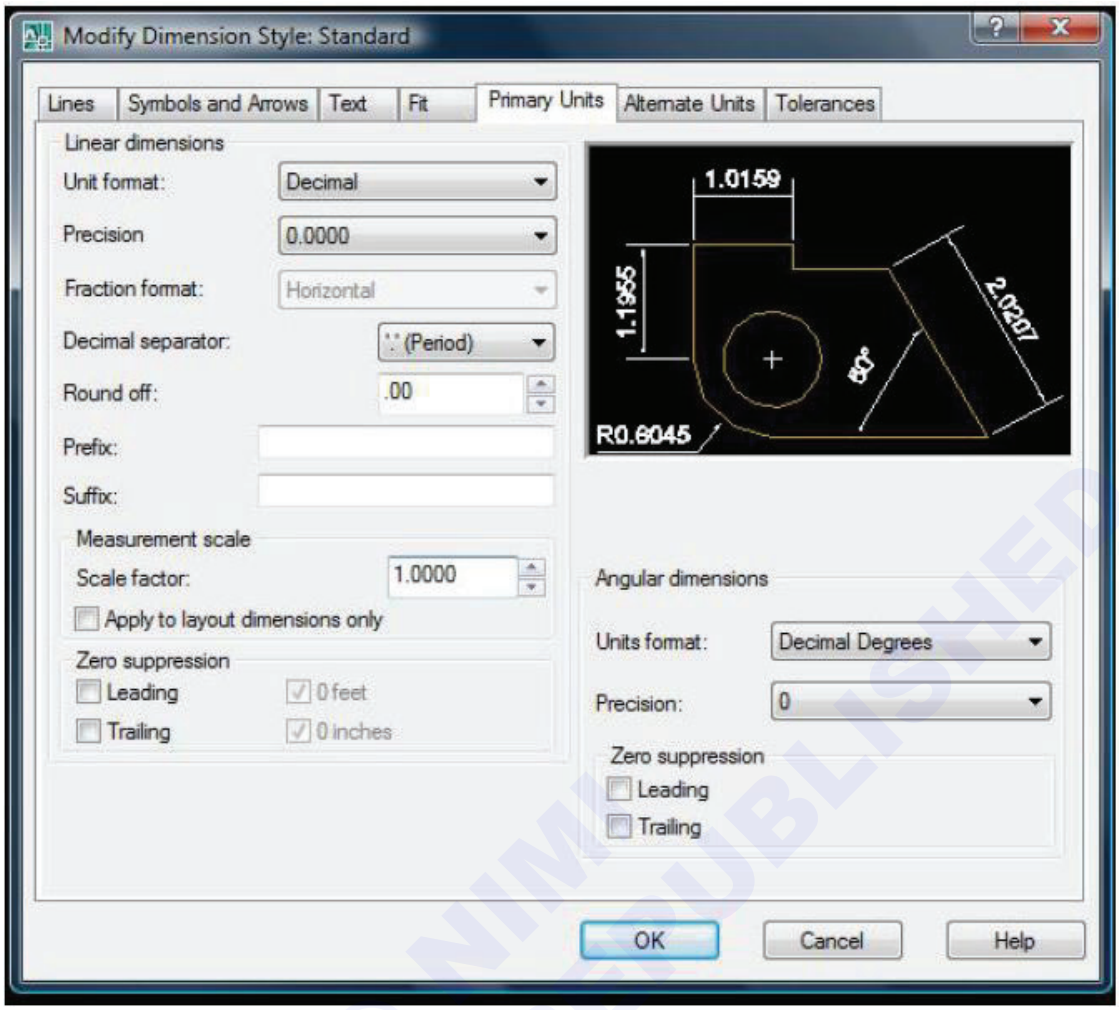
- Pull down : Draw, Text, Multi line text
- Command : MText or MT
- Current text style : " Standard"
- Text height : 0.20000
- Specify first corner : Click on the first corner
- Specify opposite comer or [Height/Justify/
- Line spacing /Rotation/Style/Width]: click on the second corner Give text height, 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.

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Fig 1



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TASK 13: **Plotting drawings (Fig 1)**

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

2 Print or plot command

3 Various input facilities are available for printing a drawing. Facilities like key board, menu bar or tool bar with mouse are explained below. (Fig 2)

Fig 1

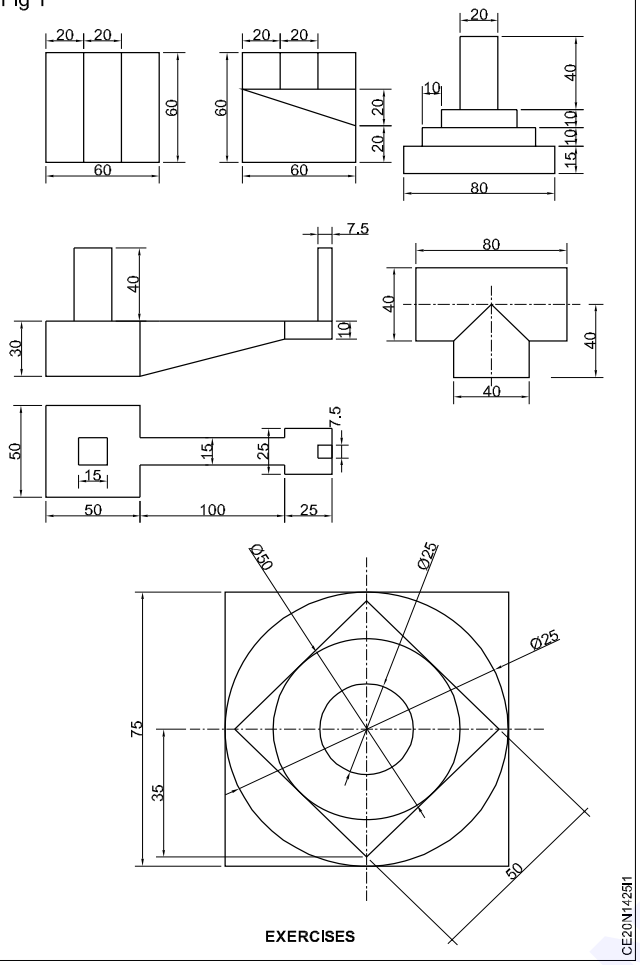
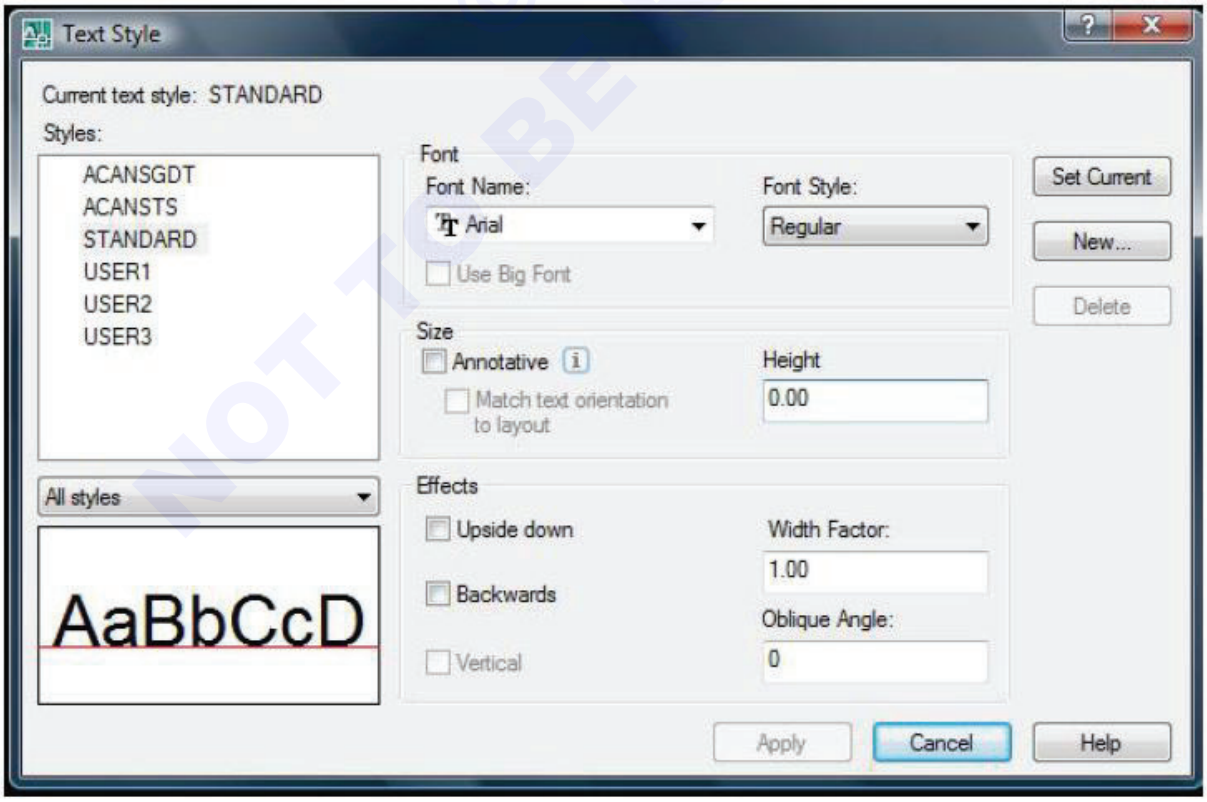


Fig 2



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Properties and blocks

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

TASK 1: **Match properties**

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

2 Pull down menu: Modify, match properties

3 Command: Match properties, MA

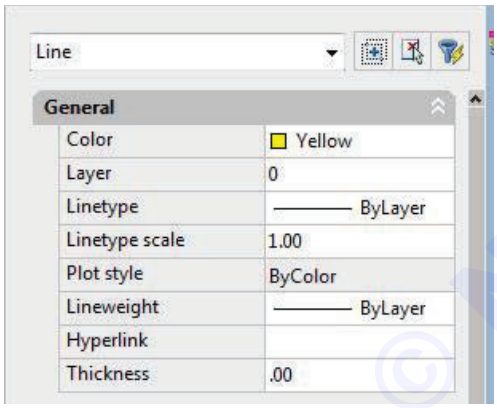
4 Select the source object: Pick the object whose property to be matched.

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

6 Select destination object(s) or [settings]

Change the properties (Fig 1)

Fig 1



7 Command: CHPROP

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

9 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
- Click ok
- Select line type from here
- Click Ok in the 'line type manager' dialogue box.

TASK 2: **Object snaps (Fig 1 &2)**

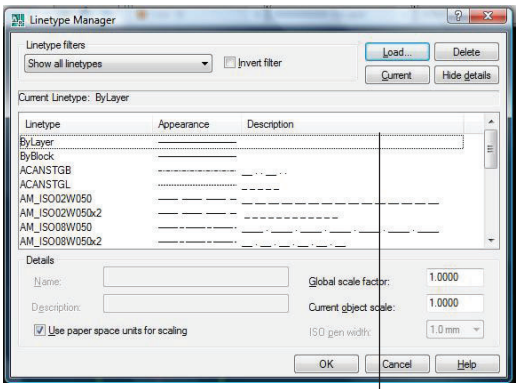
Fig 1

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

DC2613E1

Fig 2



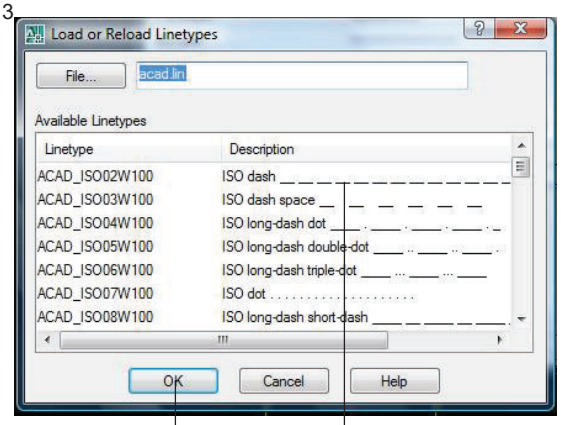
click here

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.

2 These are the object snaps (or Osnaps "Oh-Snaps"). Type os <ENTER>. You will see this dialog box appear. (Figs 3,4 and 5)

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Fig 3



Click ok

Select line type from here

Fig 4

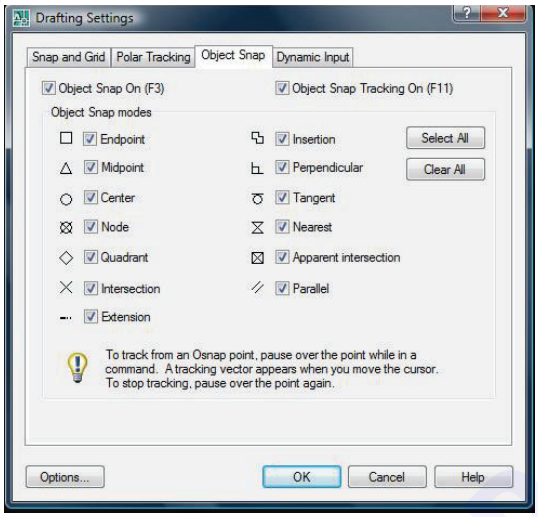
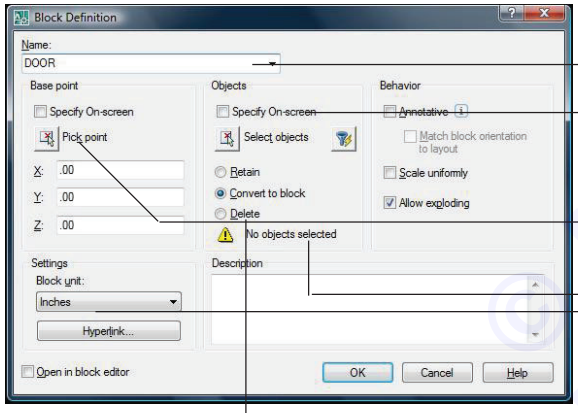


Fig 5



1 Type the name in this area, door.

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

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

4 Select.

5 Unit offered here are the drawing units.

6 Click on ok

TASK 3: **Practicing a block**

1 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

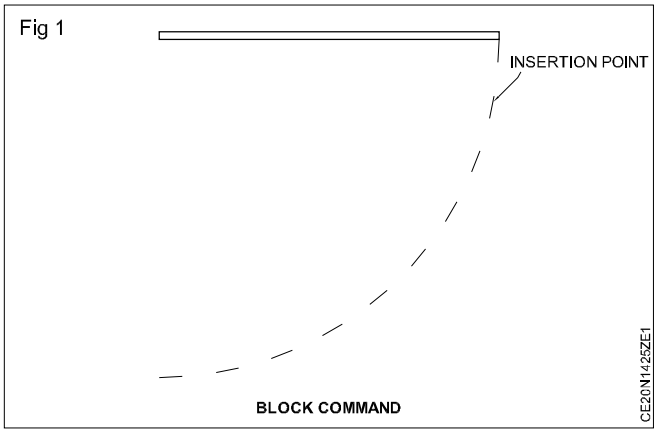
Command : Block or B

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

3 Draw a door. (Fig 1)

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

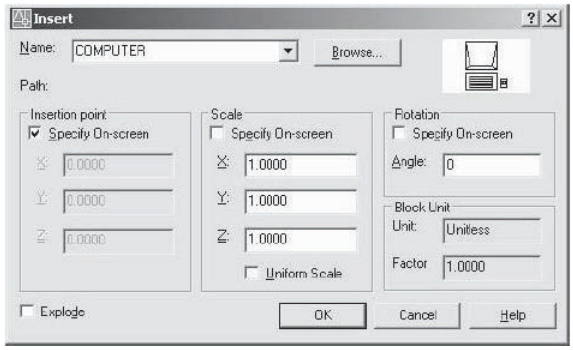
Fig 1



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Insert block (Fig 2)

Fig 2



1 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 of 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.
- Move the block in to position on the screen. The command line asks for the insertion point and lists several options. [Scale, X/Y/Z/Rotate/Scale/PX/PY/PZ/P Rotate]
- 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.

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2D drafting of flush door, paneled door, window, hand railing, wash basin, sewerage pipe joints using CAD

Objectives: At the end of this exercise you shall be able to
- **draw the flush door and panel door using auto CAD**
- **draw the window and hand rail using auto CAD**
- **draw the wash basin and sewerage pipe joints using auto CAD.**

PROCEDURE

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

— — — — — — — —

TASK 2 : **Draw a panel door to the standard 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 handle rail to the standard size as per I.S specification**

— — — — — — — —

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

— — — — — — — —

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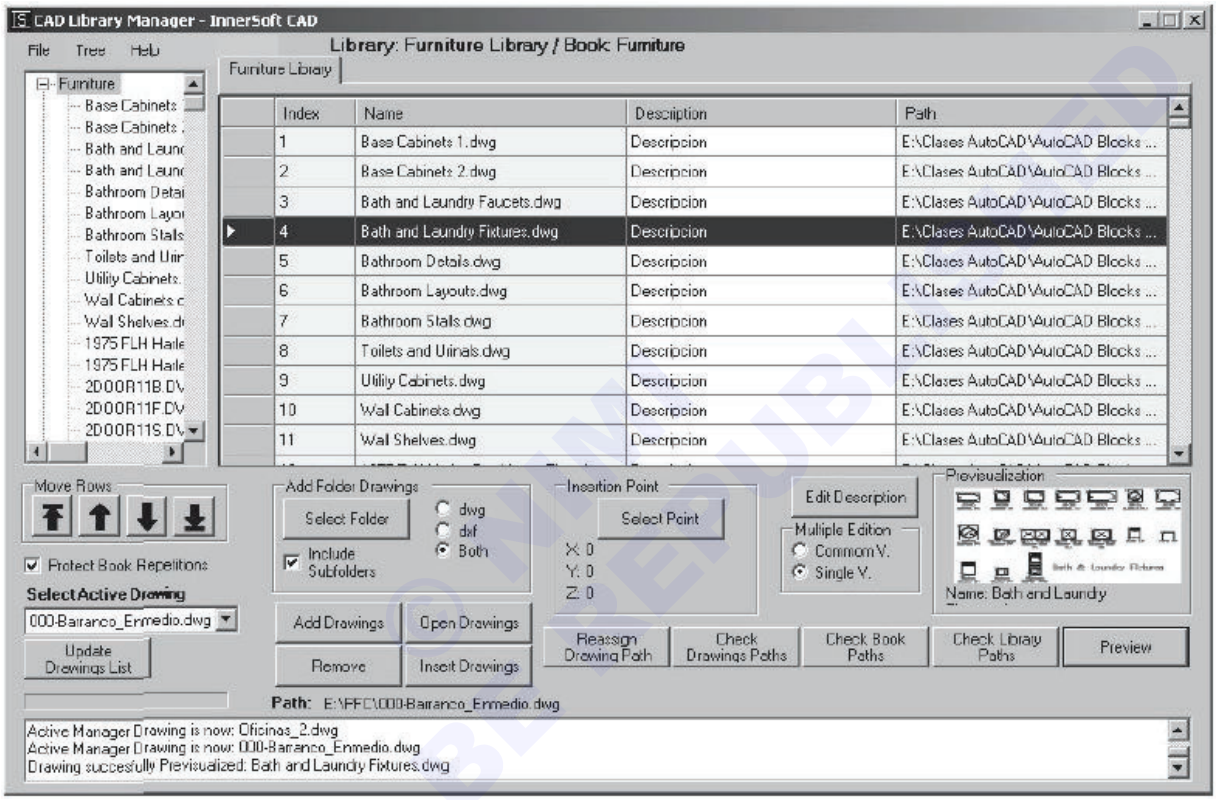
Preparing library folder by creation blocks of prepared drawings

Objective: At the end of this exercise you shall be 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 reference to the given folder using auto CAD**

Fig 1



— — — — — — — —

NOT TO BE REPUBLISHED

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 lintel**
- **calculate length of main bar, 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 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 round.

Length of lintel = $200+(2\times15)=200+30$.

= 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

= $25-2\times-(1\times0.6)$.

= 20.4 cm.

No. of main bar = 4 Nos.

No. of straight bar = 2 Nos.

No. of cranked bar = 2 Nos.

Length of straight bar = ℓ + 18 ø .

= $222+(18\times1.2)$.

= 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 = $\frac{l}{\text{spacing}}+1$.

$=\frac{222}{13}+1=18.08$

= 19 Nos .

Length of stirrup = 2 (b+d) + 18 ø.

= 2 (20.4 + 13.4) + (18 x 0.6)

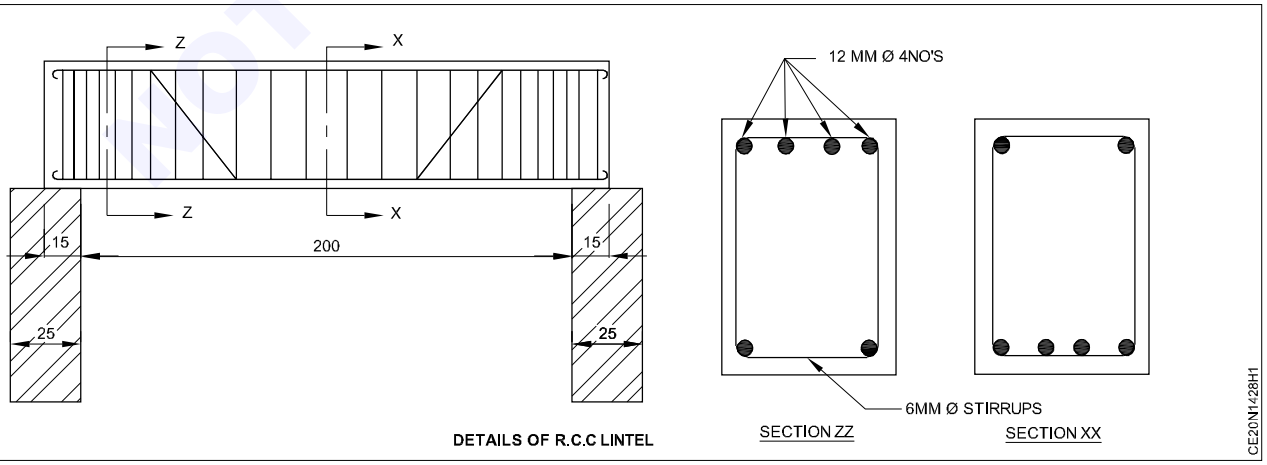
= 78.4 cm.

Length of stirrup holder = l + 18 ø .

= 222 + (18 $\times$ 0.8).

= 236.4 cm.

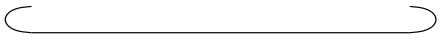
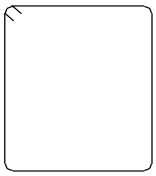
Fig 1



DETAILS OF R.C.C LINTEL

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Table 1 Bar bending 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		2	2.515	5.03	0.89	4.477
	Stirrup 6 mm ø		19	0.784	14.896	0.22	3.277
	Stirrup holder 8 mm ø		2	2.364	4.728	0.39	1.843
			Total weight = 11.497 = say 12kg Total weight In quintal $\frac{12}{100}$ = 0.12 quintal				

— — — — — — — —

TASK 2 : **Calculate the quantity of reinforcement based on shapes of reinforcement required for R.C.C beam (Fig 1 - 3)**

Fig 1

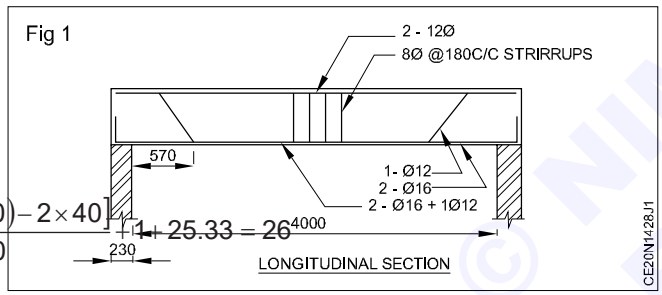


Fig 2

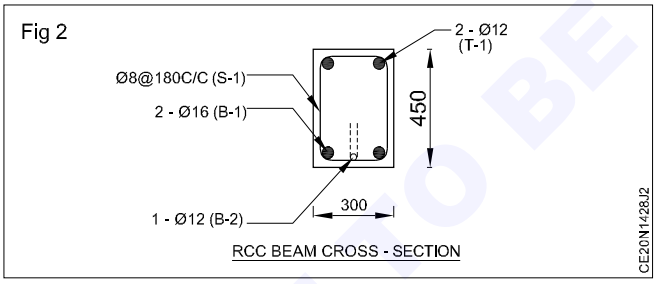
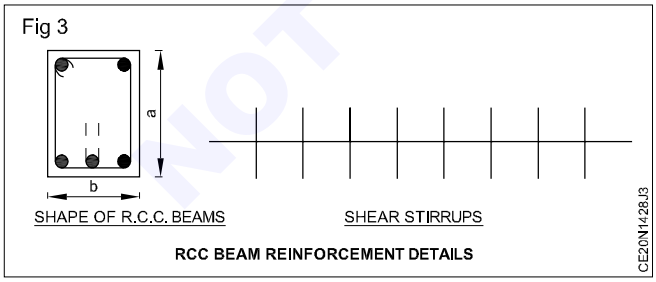


Fig 3



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 =

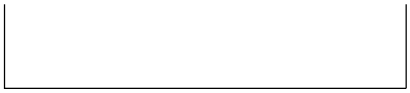
Length a = $450-2\times40=370\text{mm}$

Length b = $300-2\times40=220$

Therefore length of 1 stirrup S1 = $2\times(370+220+90)=$ 1360mm.

Where 90 mm is the minimum hook length as per IS 2502 (Fig 4) Table 2

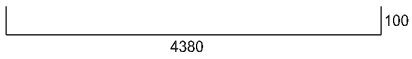
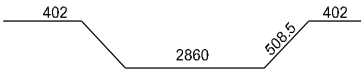
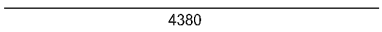
Fig 4



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Table 2

Bar bending schedule for R.C.C beam

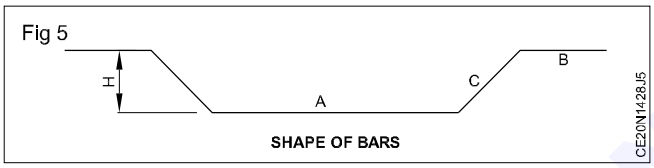
No	Description	Shape of bar with sketch	No.of bar	Length of each bar (mm)	Total length (m)	weight per meter (kg)	Total weight in kg
1	Main bar straight 16 mm#		2	4580	9.160	1.58	14.47
2	Main cranked bar 12mm #		1	4681	4.681	0.89	4.17
3	Top bar 12mm# (Hanger bar)		2	4380	8.76	0.89	7.80
4	Stirrups 8mm#		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



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. (Fig 6)

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

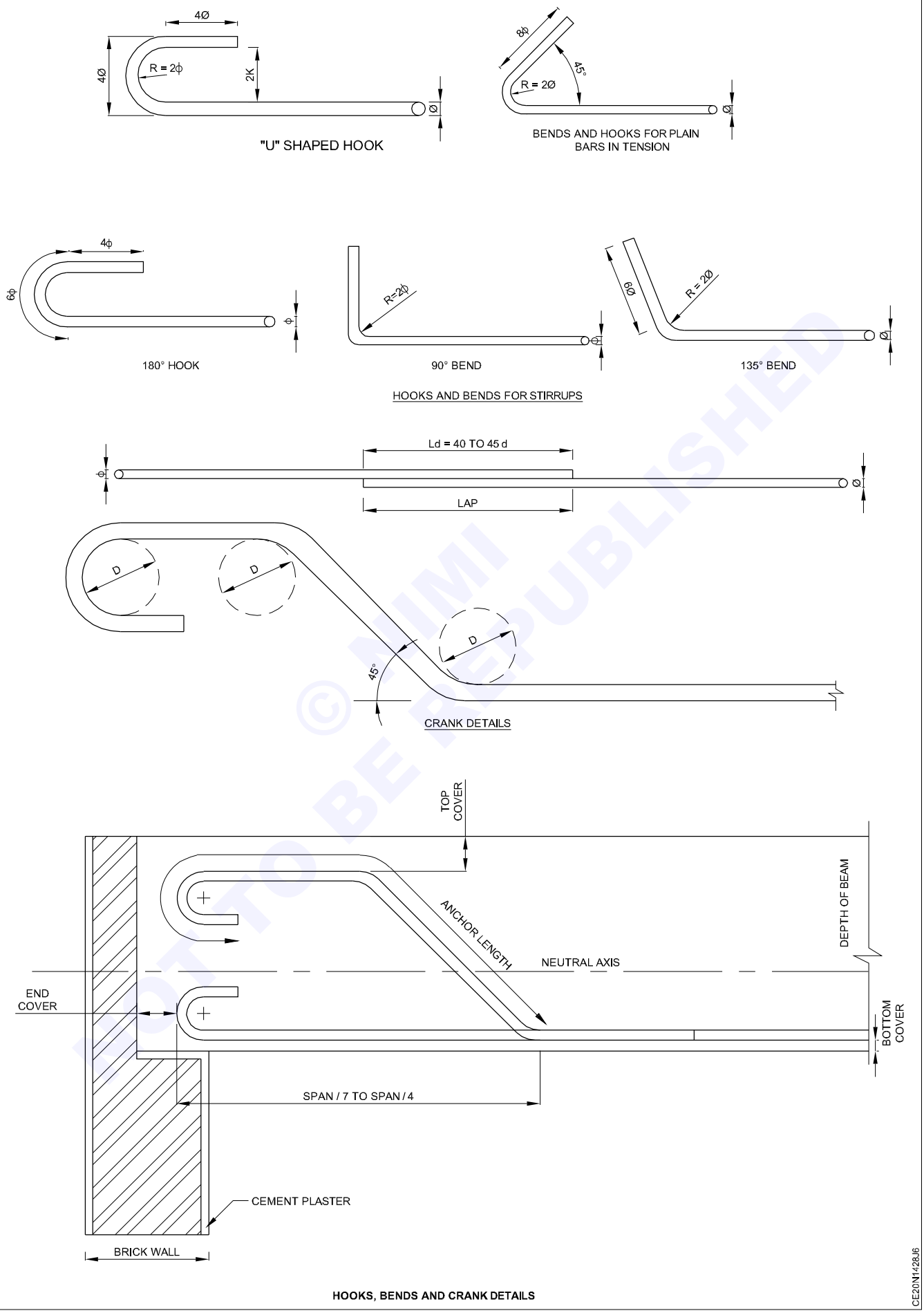
H = 450 - 2 $\times$ 40 - 2 $\times$ 12/2 = 358 mm

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 7)

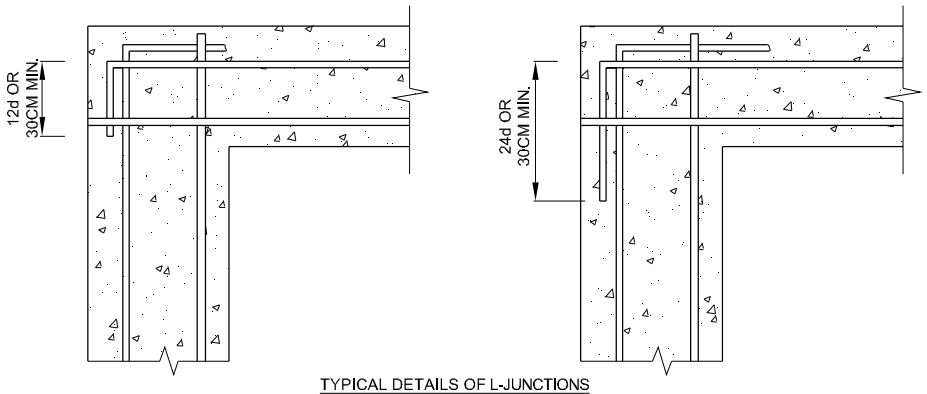
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Fig 6

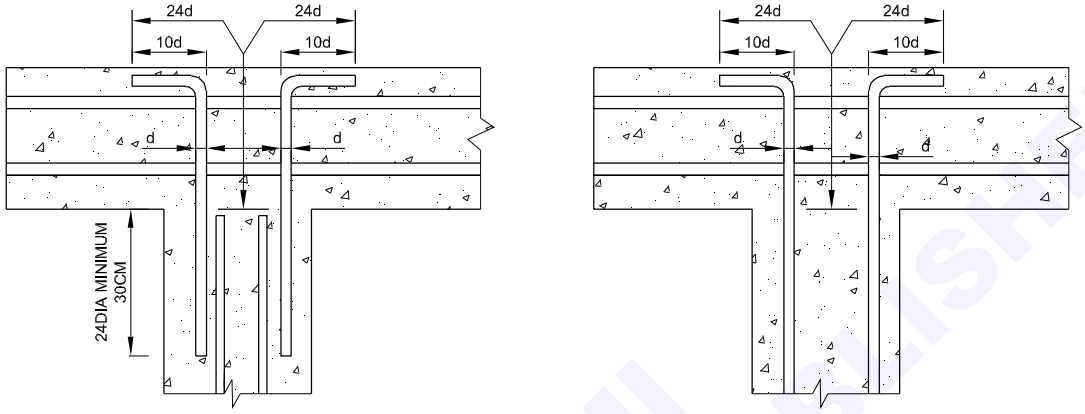


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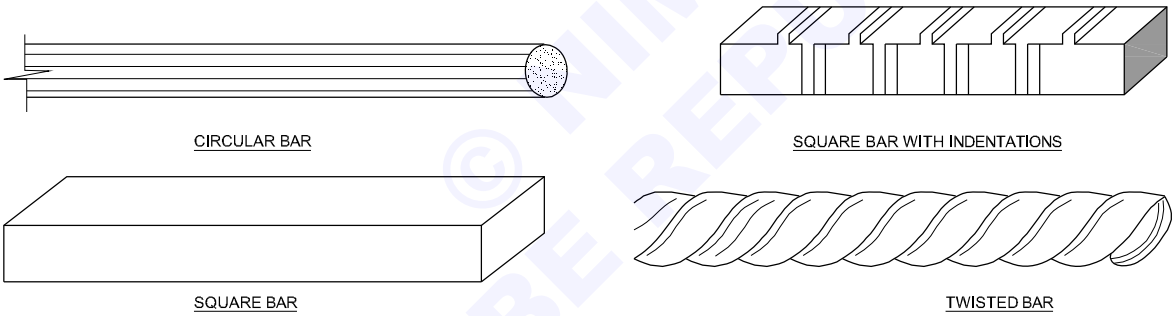
Fig 7



TYPICAL DETAILS OF L-JUNCTIONS



TYPICAL DETAILS OF T - JUNCTIONS



CIRCULAR BAR

SQUARE BAR WITH INDENTATIONS

SQUARE BAR

TWISTED BAR

DETAILS OF JUNCTIONS

CE20N1428J7

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Identify different types of bricks and hollow bricks, uses

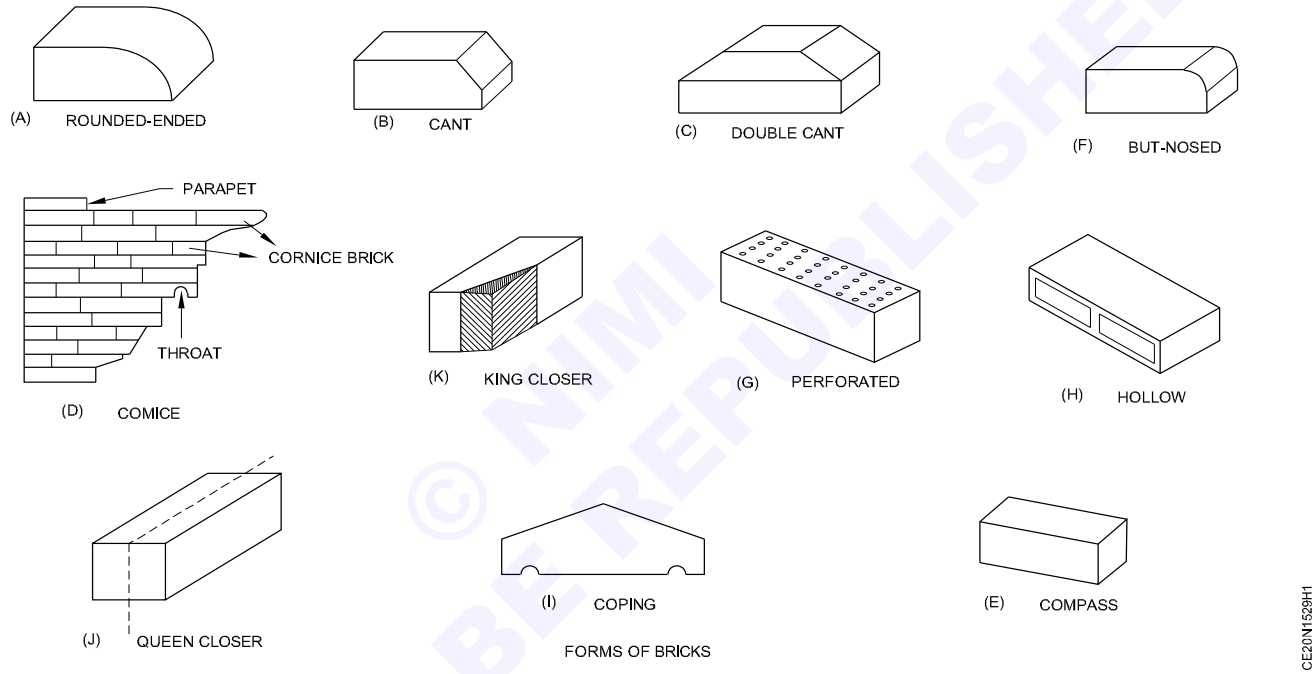
Objective: At the end of this exercise you shall be able to
- **identify different types of bricks and hollow bricks and uses, size.**

PROCEDURE

TASK 1: **Identify different types of bricks and hollow bricks and uses (Fig 1)**

Instructor may arrange different types of bricks, hollow bricks in the table or provide the chart showing the bricks. Explain the name, uses and size

Fig 1



- Trainees will note name, uses and size of bricks
- Record it in table - 1
- Get it checked by your instructor.

Table 1

S. No	Name	Use	Size
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			

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Identify Different types of stones masonry and uses

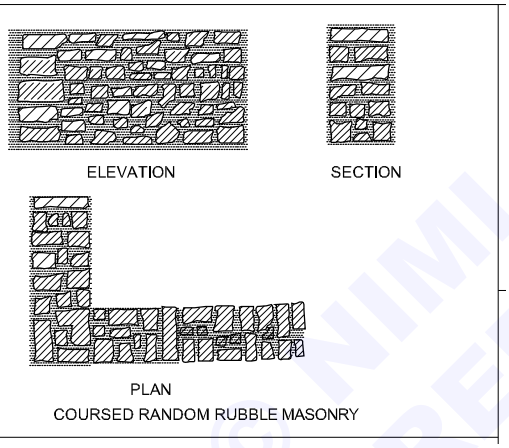
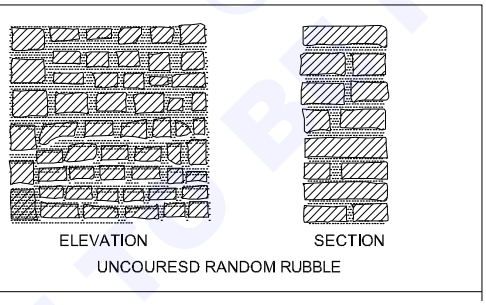
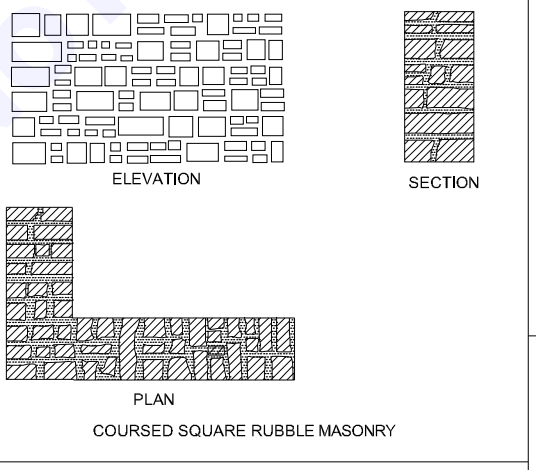
Objectives: At the end of this exercise you shall be able to
- **identify different types of stones and uses.**

PROCEDURE

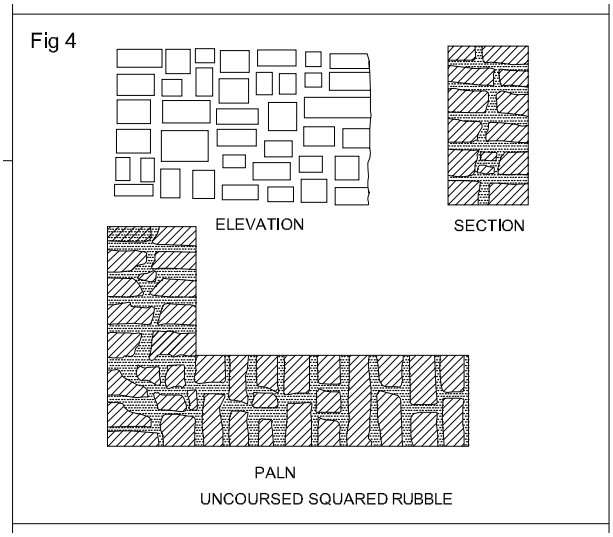
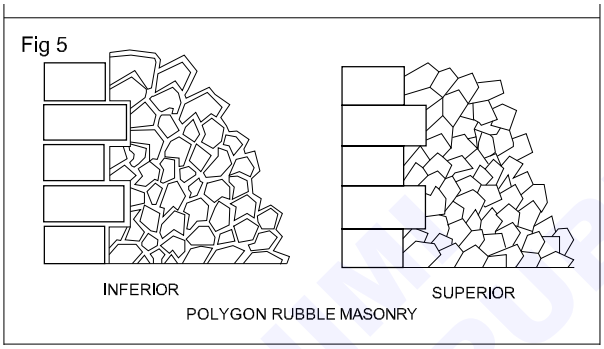
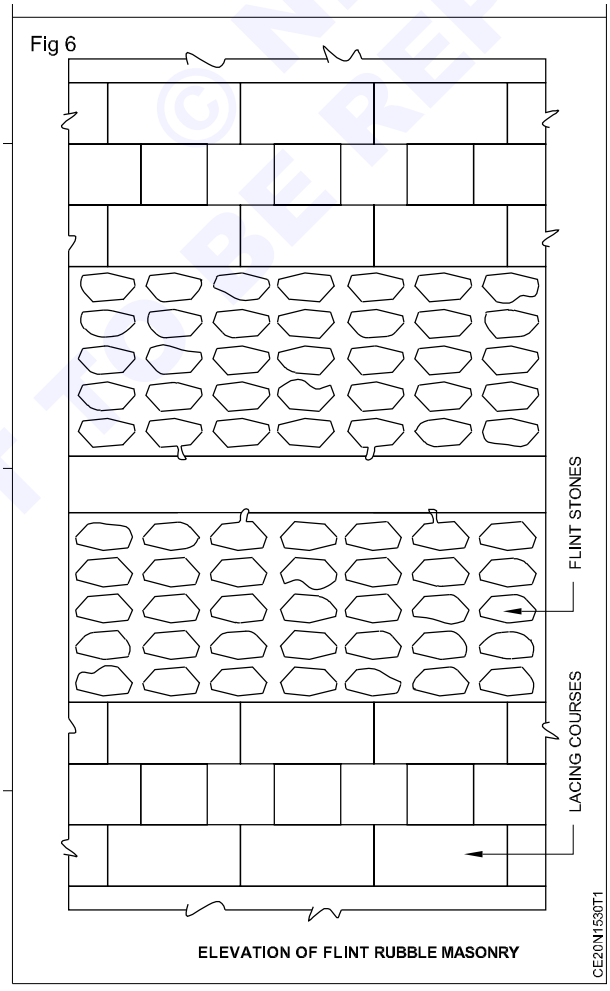
Instructor may arrange different types of stones masonry in the section or provide the chart showing the stones and explain the types name and uses.

TASK 1: **Identify different types stones and uses (Fig 1 - 7)**

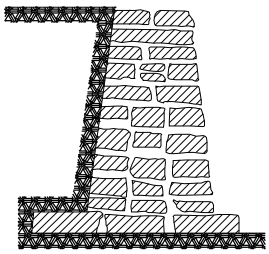
Table 1

S. No	Name
1	Fig 1  COURSED RANDOM RUBBLE MASONRY
2	Fig 2  UNCOURESD RANDOM RUBBLE
3	Fig 3  COURSED SQUARE RUBBLE MASONRY

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S. No	Name
4	Fig 4 
5	Fig 5 
6	Fig 6 

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S. No	Name
7	Fig 7  DRY RUBBLE MASONRY

- Trainees will note down types, name of masonry stones
- Record it in table 2
- Get it checked by your instructor.

Table 2

S. No	types	name	uses
1			
2			
3			
4			
5			
6			
7			

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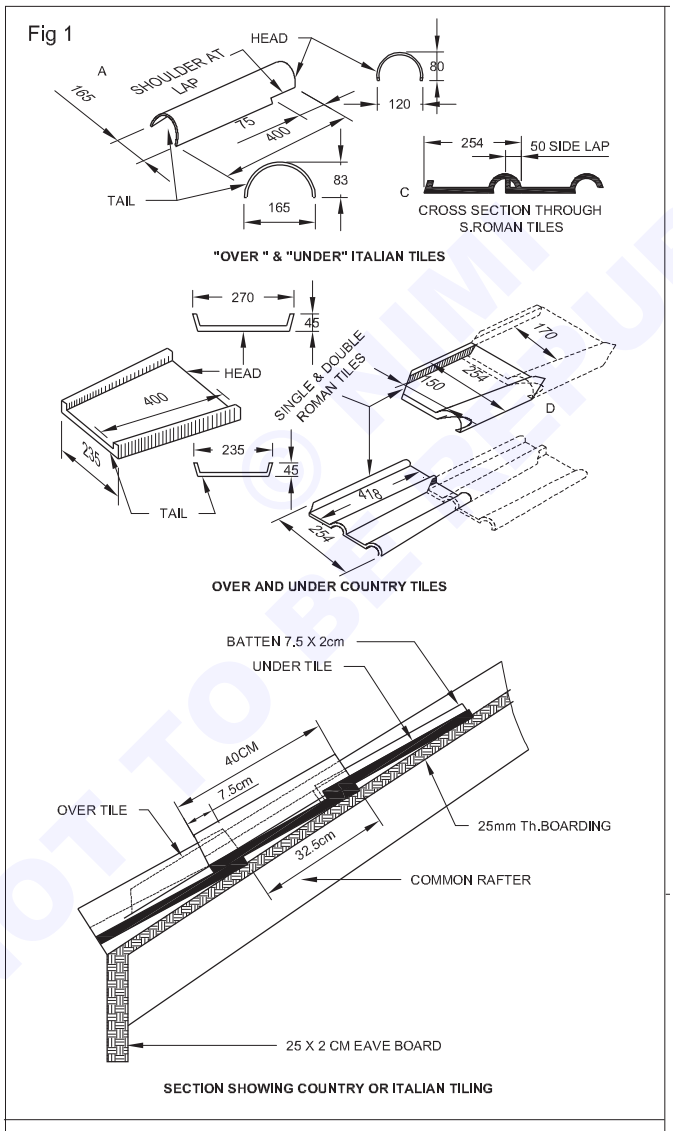
Identify different types of tiles and uses

Objective: At the end of this exercise you shall be able to
- **identify different types of tiles and their uses.**

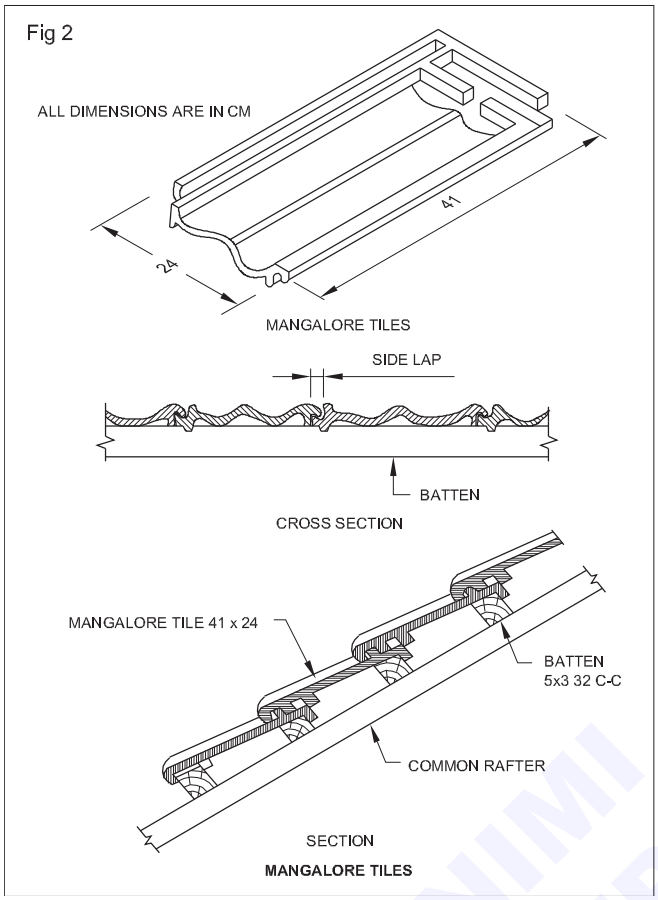
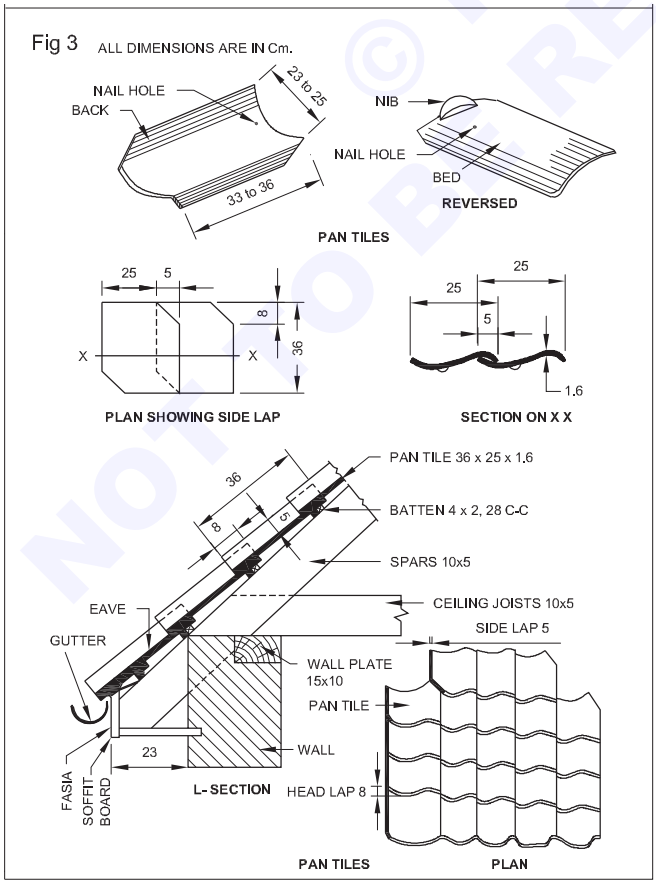
PROCEDURE

Instructor may arrange different types of tiles in the section or provide the chart showing the tiles. Explain the types name and uses

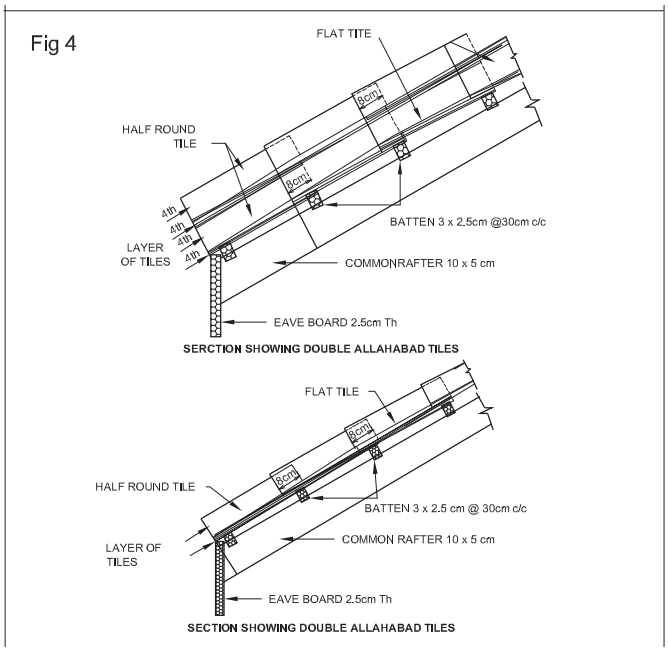
TASK 1: **Identify different types of tiles names and uses (Fig 1 - 4)**

S. No	Name
1	Fig 1 

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S. No	Name
2	
3	

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S. No	Name
4	Fig 4 

- Trainees will note down types, name and uses of tiles.
- Record it in table 1
- Get it checked by your instructor.

Table 1

Fig. No	types	name	uses
1			
2			
3			
4			

— — — — — — — —

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Identify different types of cement and uses, field test of cement

Objective: At the end of this exercise you shall be able to
- **identify different type of cement and uses**
- **carry/out the field test and ascertain the quality of cement.**

PROCEDURE

Instructor may arrange different types of cement in the section or provide the chart showing the cement. Explain the types and uses

TASK 1: **Identify different types of cement and uses, (Fig 1 - 12)**

Fig 1



OPC

Fig 2



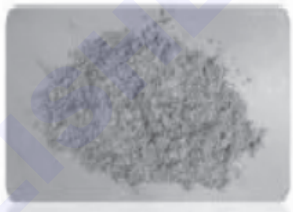
Rapid Hardening Cement

Fig 3



Quick Setting Cement

Fig 4



Low Heat Cement

Fig 5



Sulphate Resisting cement

Fig 6



Blast Furnace Slag Cement

Fig 7



High Alumina Cement

Fig 8



White Cement

Fig 9



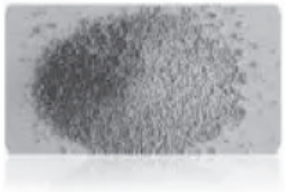
Colored Cement

Fig 10



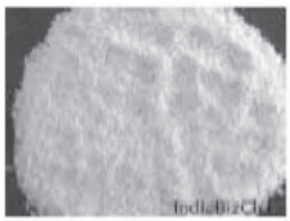
Pozzolanic Cement

Fig 11



Air Entraining Cement

Fig 12



Hydrophobic cement

- Trainees will note down types, and uses of cement.
- Record it in table - 1
- Get it checked by your instructor.

Table 1

Fig . No	type	uses	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

TASK 2: **Instructor should prepare a chart or PPT of the given below topics and as far as possible demonstrate each one of them (Fig 1 to 5)**

1 **Colour -** Greenish grey.

2 **Presence of lumps -** Pressed between the thumb and fore finger and it should be powdered.

3 **Rubbing** - When rubbed between the fingers it should be felt smooth.

4 **Water** - when a hand full of cement thrown into the bucket of water, it should float .

5 **Bag of cement** - Hand should feel cold when the hand is insered into a bag of cement.

Fig 1



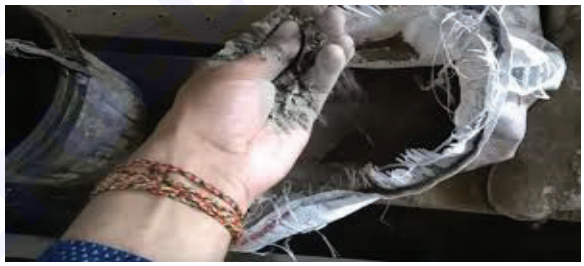
Colour: Greenish grey

Fig 2



Presence of lumps

Fig 3



Rubbing between fingers

Fig 4



Water

Fig 5



Bag of cement

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Identify different types of sand, aggregate and uses

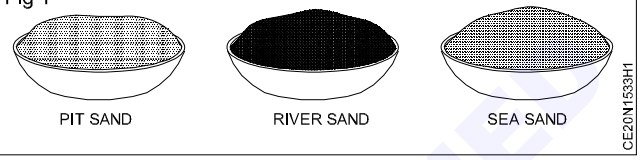
Objectives: At the end of this exercise you shall be able to
- **identify the types of sand and uses**
- **identify the classification of sand aggregate and uses.**

PROCEDURE

TASK 1: **Identify the types of sand shown (Fig 1)**

Instructor should demonstrate each types of sand and explain their uses.

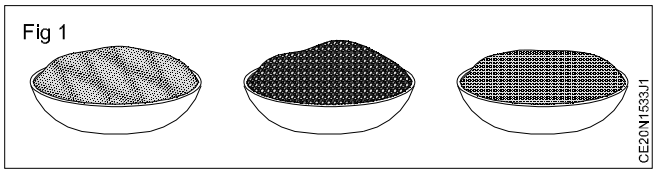
Fig 1



— — — — — — — —

TASK 2: **Identify the classification aggregate (Fig 1)**

Fig 1



Instructor should demonstrate the classification of aggregate shown in figure.

- Trainees will note down types, and uses of stone and aggregate
- Record it in table - 2
- Get it checked by your instructor.

Table 1 (TASK 1)

Fig. No	types of sand	uses
1		
2		
3		

Table 2 (TASK 2)

Fig. No	types of aggregate	uses
1		
2		
3		

— — — — — — — —

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Identify different types of lime and uses

Objective: At the end of this exercise you shall be able to
- **identify classification of lime as per IS: 712 -1973 and uses.**

PROCEDURE

TASK 1: **Identify classification of lime as per IS: 712 -19733**

Note: Instructor should show the classification of lime of small quantity in a bowl. So that trainees can visualize directly. Also explain each classification and its uses (Fig 1 to 6).

Fig 1



Hydraulic lime

Fig 2



Semi hydraulic lime

Fig 3



Fat lime

Fig 4



Magnesium dolomite lime

Fig 5



Kankar lime

Fig 6



Sicilians lime

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Identify different types of steel and uses

Objective: At the end of this exercise you shall be able to
- **identify different types of steel and uses.**

PROCEDURE

Instructor may arrange different types of small steel bar in the section or provide the chart showing the steel bar. Explain the types and uses

TASK 1: **Identify different types of steel used in R.C.C work (Fig 1 to 16)**

Fig 1



TWIN TWISTED BARS

CE20N1535H1

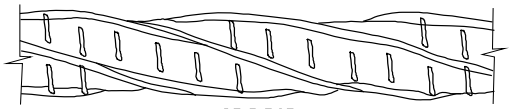
Fig 2



RIBBED TORSTEEL

CE20N1535H2

Fig 3



GRIP BAR

CE20N1535H3

Fig 4



TRSTRONG BAR 1 & 2

CE20N1535H4

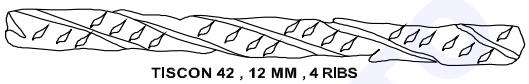
Fig 5



TISCON 42 , 12 MM , 2 RIBS

CE20N1535H5

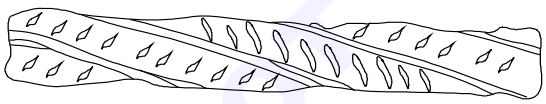
Fig 6



TISCON 42 , 12 MM , 4 RIBS

CE20N1535H6

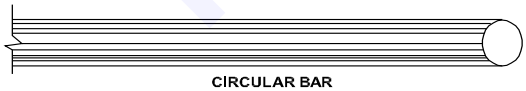
Fig 7



TISCON 42 , 20 MM , 4 RIBS

CE20N1535H7

Fig 8



CIRCULAR BAR

CE20N1535H8

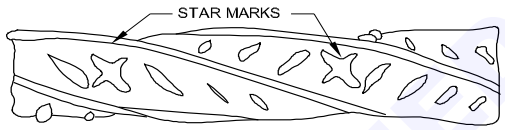
Fig 9



TISCON 50 , 12 MM , 2 RIBS

CE20N1535H9

Fig 10



TISCON 50 , 20 MM , 4 RIBS

CE20N1535HA

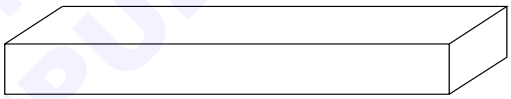
Fig 11



TISCON 50 , 20 MM , 4 RIBS

CE20N1535HB

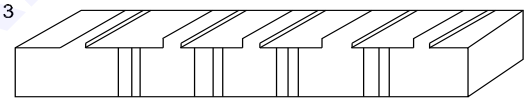
Fig 12



SQUARE BAR

CE20N1535HC

Fig 13



SQUARE BAR WITH INDENTATIONS

CE20N1535HD

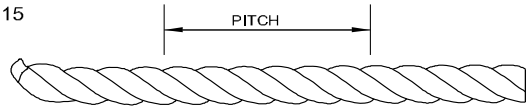
Fig 14



TWISTED BAR

CE20N1535HE

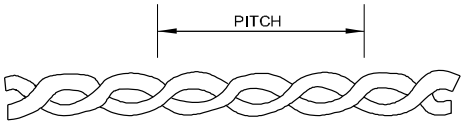
Fig 15



SINGLE - SQUARE TWISTED BAR

CE20N1535HF

Fig 16



TWIN TWISTED BAR
TWISTED BARS

CE20N1535HG

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Identify different types of timber and earthenware and uses

Objectives: At the end of this exercise you shall be able to
- **identify different types of timber and uses**
- **identify different types of earthenware and uses.**

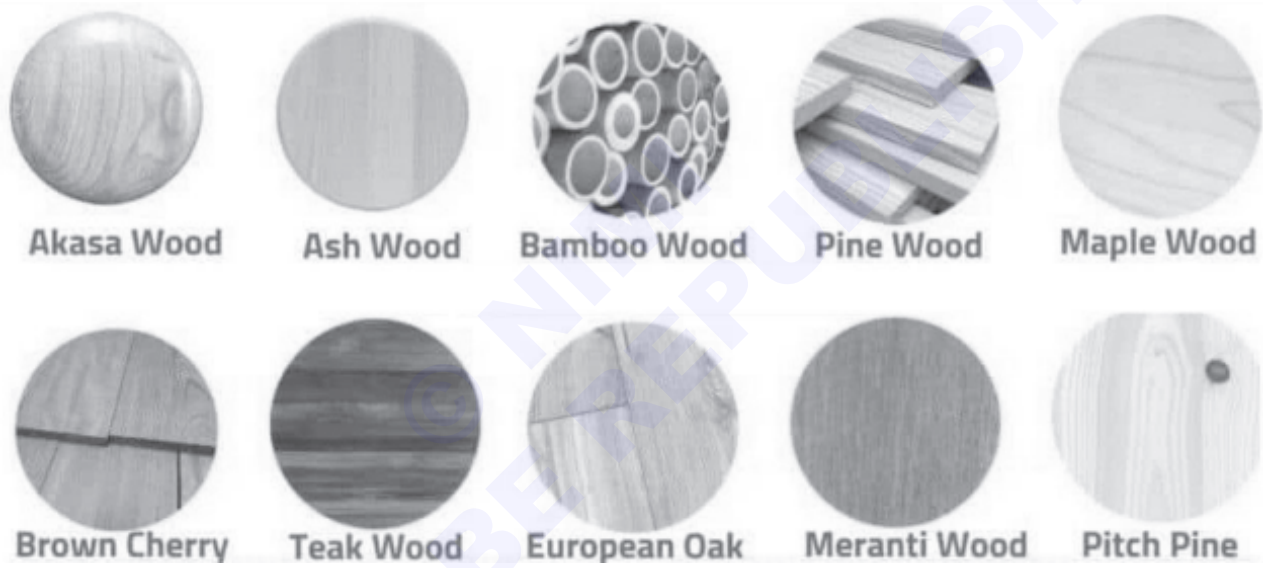
PROCEDURE

TASK 1: **Identify different types of timber (Fig 1)**

Note: Instructor should show different types of timber by means of a wall chart or by PPT. He should also arrange small piece of different types of wood shown in figure.

Trainees should identify different types of wood by its colour.

Fig 1



— — — — — — — —

TASK 2: **Identify different types of earthenware (Figs 1 - 3)**

1 Following figures some of the product of earthenware.

Note: Instructor should arrange sample of earthenware and demonstrate to the trainees with examples.

Fig 1

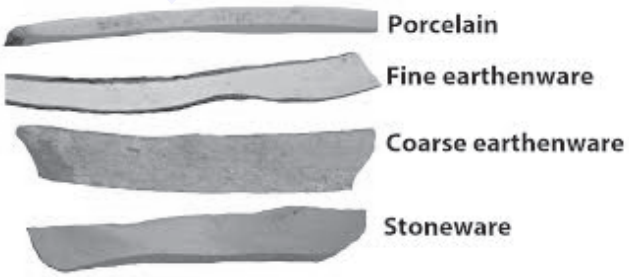


Fig 2



Trainees should identify the earthenware and the corresponding samples.

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1 Trainees will note down types and uses, timber and earthen ware.

2 Record it in table 1 and 2

3 Get it checked by your instructor.

Fig 3



— — — — — — — —

Table 1

Fig. No	Timber type name	Colour	Uses
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Table 2

Fig. No	Earthen ware types	Uses
1		
2		
3		

— — — — — — — —

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Setting out a building - obtaining first, second, third and fourth lines marking diagonals, setting out cross walls and offsets

Objectives: At the end of this exercise you shall be able to
- **study and inspect the plot and drawing**
- **marking first, second line of building.**

Requirements

Tools/Equipments

- Builders square steel 75 cm x 50 cm - 1 No.
- Nylon marking thread
- Hammer Mason (club) 11/2/1 lb - 1 No.
- Measuring tape 30 m - 1 No.
- Spade, Plumb bob - 1 No.
- Steel tri square 75cm x 50cm - 1 No.
- Sprit level 15 cm - 1 No.
- Nylon line thread - 1 No.
- Tube level - 1 No.

Materials

- Wooden pegs (about 80 to 100mm diameter and 450 to 600mm casurina poles), 35mm long wire nails and lime powder
- Wooden profiles - 12 Nos.
- Wire Nails - 20 Nos.
- Lime powder - 2 Kg.
- Pegs - 10 Nos.
- Water - as reqd.

PROCEDURE

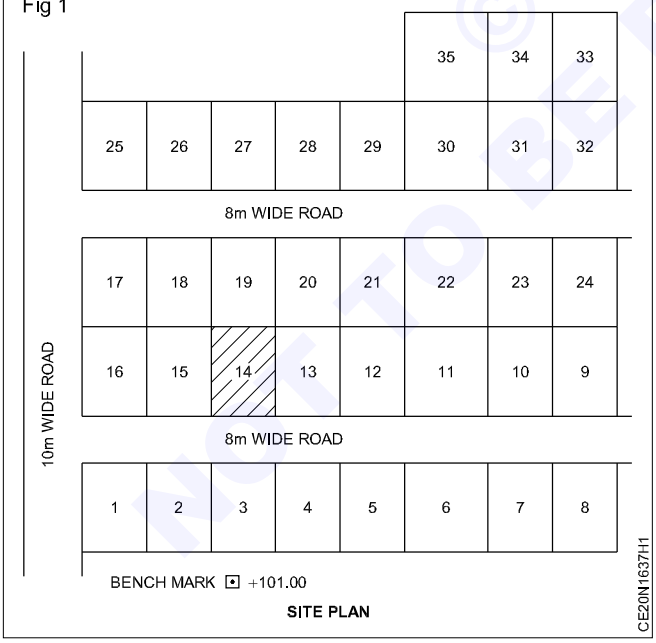
TASK 1: **Study and inspect the plot and drawing**

1 Inspect the plot where setting out is to be done.

2 Study plot layout drawing.

3 Study Building drawing (Fig 1)

Fig 1



4 Locate boundary points A,B,C,D of the plot (Set back layout) (Fig 2).

5 Clear vegetation, and debris

6 Level the ground to required gradient.

7 Study orientation of the building.

8 Calculate and note the overall length and breadth of the building. Measure width of the road.

9 Mark center of the Road at several points and produce line RM (Fig 3).

Note road widening measurements.

Note local authority frontage (minimum three meter) and side set back (minimum one and half meter) rules.

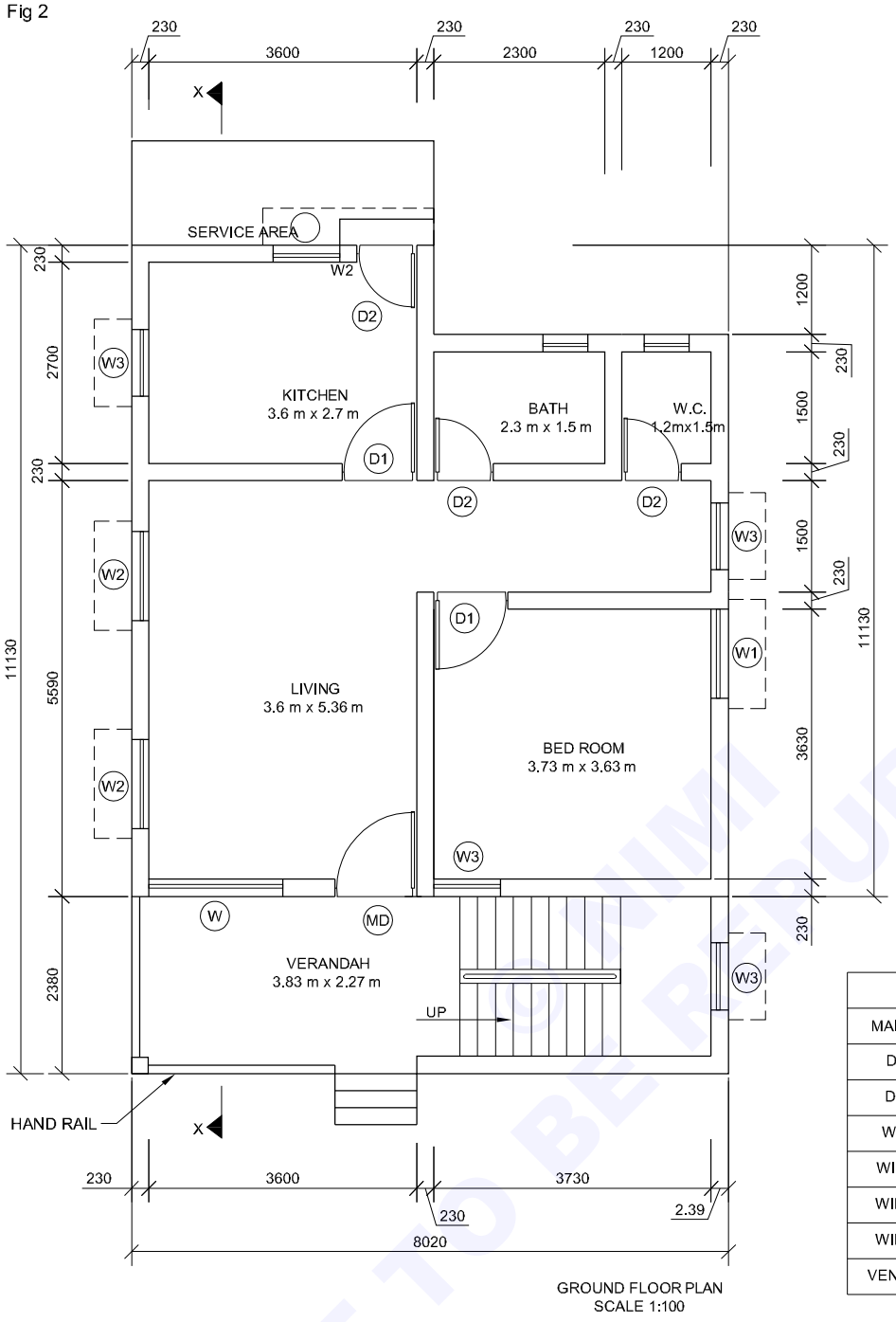
10 Calculate building frontage ie half road width including widening plus three meter

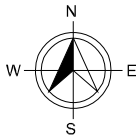
11 Have left side back as one and half meter.

12 Prepare layout sketch showing set back dimensions (Fig 3).

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Fig 2





NOTE:
1. ALL DIMENSIONS ARE IN mm.
2. ALL WALLS ARE 230 mm THICK.

SCHEDULE OF JOINERY		
MAIN DOOR	MD	1000 x 2100 mm
DOOR-1	D1	900 x 2100 mm
DOOR-2	D2	750 x 2100 mm
WINDOW	W	1800 x 1350 mm
WINDOW-1	W1	1500 x 1350 mm
WINDOW-2	W2	1200 x 1350 mm
WINDOW-3	W3	900 x 1350 mm
VENTILATOR	V	600 x 600 mm

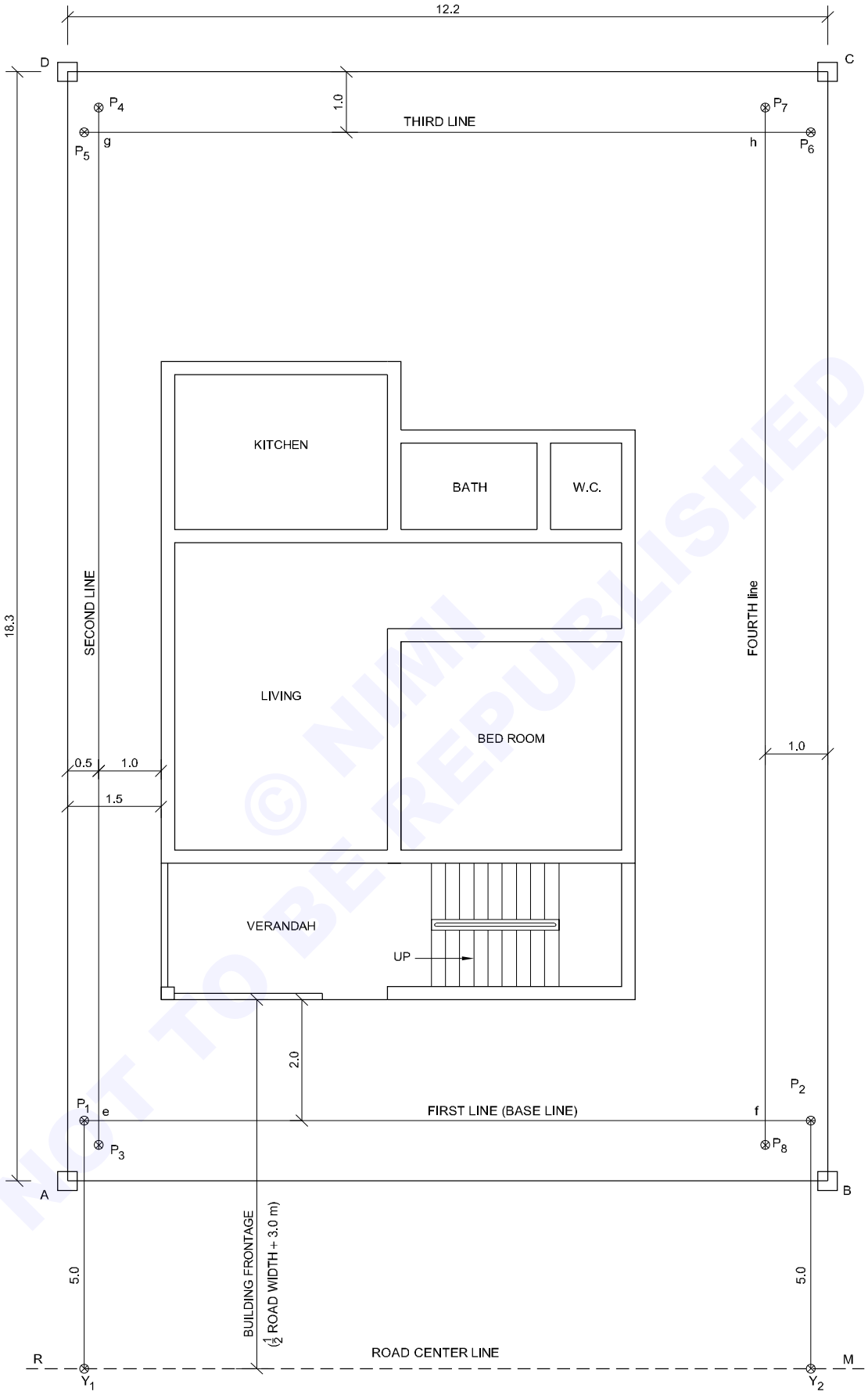
GROUND FLOOR PLAN
SCALE 1:100

BUILDING DRAWING

CE20N1637H2

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Fig 3



NOTE:
1. WIDTH OF ROAD INCLUDING WIDENING = 8.0 m
2. ALL DIMENSIONS ARE IN METER

SET BACK LAYOUT

CE20N1637H3

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TASK 2 : **Marking first line of building**

Marking firstline (base line)

1 Calculate half of road width including future widening (four meter) and add three meter to get the measurement of frontage (i.e Seven meter)

2 Locate points Y1 and Y2 on line RM so as to cover the overall dimensions of the front side of buildings and also foundation excavation width plus safe distance.

3 Locate points Y1 and Y2 on line RM so as to cover the overall dimensions of the front side of the building and also foundation excavation width plus safe distance.

4 Measure an arbitrary distance of five meter at point Y1 at right angle to line RM and mark point P1 and drive wooden peg firmly into the ground.

5 Measure an equal distance of five meter at point Y2 at right angle to line RM and mark point P2 and drive wooden peg firmly into the ground.

6 Plumb at point Y1 and measure five meter and mark on the top of peg at point P1 and drive nail.

7 Tie line thread on the nail at peg P1 and stretch thread to appear on the peg at P2.

8 Plumb at point Y2 and measure five meter and mark on the top of peg at point P2 and drive nail so as to be at center of line thread

Caution: Verify correctness of measurement and adjust thread line and nail point only at peg P2.

9 Tie the line thread on the nail in peg P2 and obtain the first line (Base line) P1 P2 parallel to road center line RM

— — — — — — — —

TASK 3: **Marking second line of the building**

1 Measure an arbitrary distance of half metre from boundary AD and locate points p3 and p4 so as to cover the overall dimensions of the left side of the building and also foundation excavation width and safe distance.

Caution: While measuring stretch and hold the steel tape without sag, and as low as possible, clear above the ground and truly horizontal to the ground.

2 Drive pegs at points P3 and P4

3 Drive nail on center of peg P3 and tie line thread

4 Stretch the line thread at right angles using the builders square (Fig 3) to line P1, P2 and to appear on peg at P4

5 Locate nail point on peg P4 and drive nail so as to be at center of line thread.

Caution: Verify correctness of measurement and adjust the line thread and nail point only at peg P4.

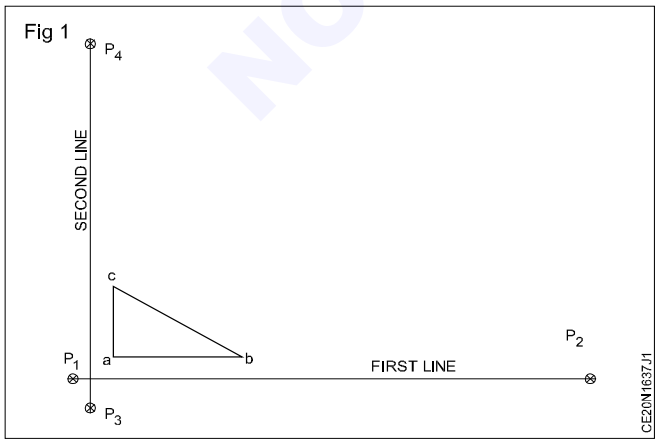
6 Tie the line thread on the nail in peg P4 and obtain the second line P3 P4 at right angles to line P1 P2.

Skill sequence

Uses of builders square

Objectives: This shall help you to
- **use builders square**
- **obtain right angle**
- **check back for square.**

Fig 1



Steps

Hold builders square on both hands firmly (Fig 1).

Place side a, b parallel and abutting the first line (Fig 1).

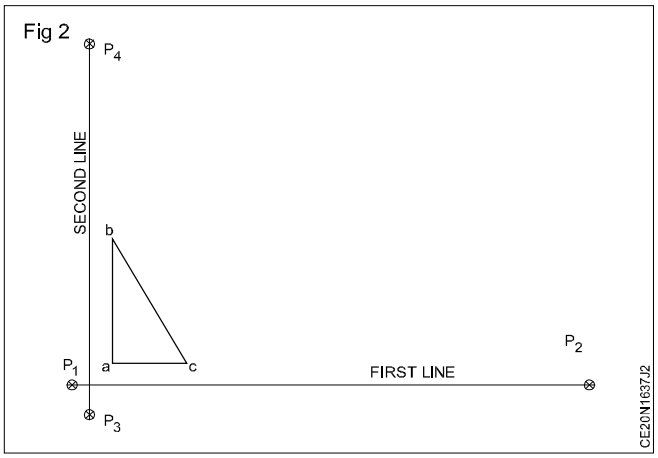
Keep corner “a” at the point where right angle turn is required.

Keep side a, c pointing in the direction of right angle turn is required.

Stretch second line parallel and abutting builders square side a, c (Fig 1).

When second line is parallel to side a, c keeping the first line parallel side a, b the right angle turn has been obtained.

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Turn builders square and keep side a, b on second line, and verify whether side a, c is parallel to first line (Fig 2) and if it is parallel check back for square has been done.

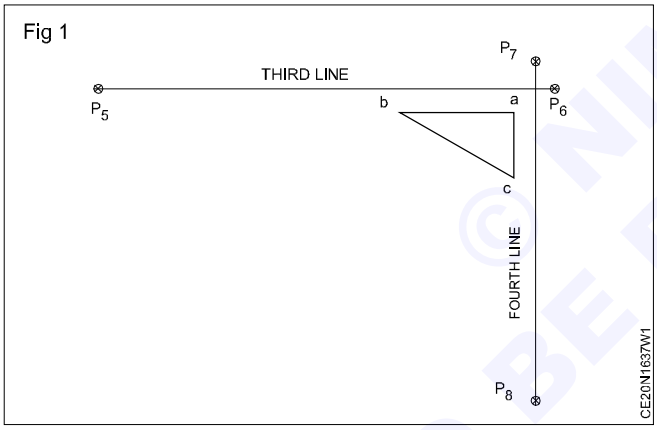
Caution: Adjust only second line to achieve true alignment parallel to builders square side a, c hold builders square without much shake.

Set out a building - marking third and fourth line

Objective : This shall help you to
- **mark third line of the building**
- **mark fourth line of the building.**

Mark third line of the building (Fig 1)

Measure an arbitrary distance of one meter from boundary DC and locate points P5 and P6 so as to cover the over all dimensions of the rear side of the building and also foundation excavation width and safe distance.



Caution: While measuring, stretch and hold the steel tape without sag, and as low as possible clear above the ground and truly horizontal to the ground.

Drive pegs at points P5 and P6

Drive nail on centre of peg P5 and tie line thread

Stretch the line thread at right angles using the builders square (Fig 1) to line P3, P4 and to appear on peg at P6

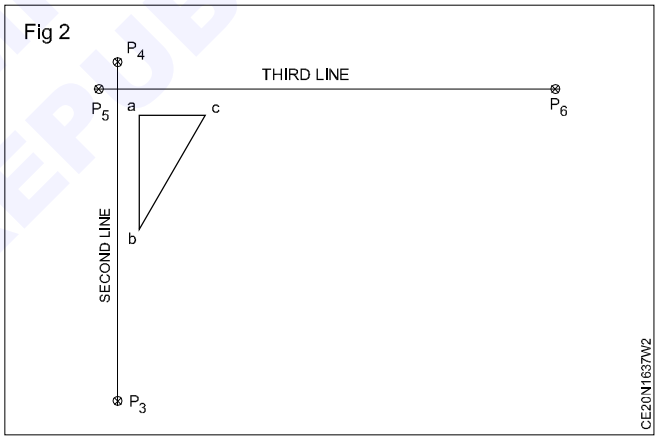
Locate nail point on peg P6 and drive nail so as to be at centre of line thread.

Caution: Verify correctness of measurement and adjust the line thread and nail point only at peg P6.

Tie the line thread on the nail in peg P6 and obtain the Third line P5 P6 at right angles to line P3, P4 and parallel to line P1 & P2.

Mark fourth line of the building (Fig 2)

Measure an arbitrary distance of one meter from boundary C,B and locate points P7 and P8 to as to cover the overall dimensions of the right side of the building and also foundation excavation width and safe distance.



Caution: While measuring, stretch and hold the steel tape without sag, and as low as possible clear above the ground and truly horizontal to the ground.

Drive pegs at points P7 and P8.

Drive nail on center of Peg P7 and tie line thread

Stretch the line thread at right angles using the builders square (Fig 1) to line P5, P6 and to appear on peg at P8.

Locate nail point on Peg P8 and drive nail so as to be center of line thread.

Caution: Verify correctness of measurement and adjust the line thread and nail point only at peg P 8.

Tie the line thread on the nail in Peg P 8 and obtain the Fourth line P7 P8 at right angles to line P5 P6 and parallel to the line P3P4

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Measure diagonal distance between intersection points e and h (Fig 3)

Measure diagonal distance between intersection, points g and f (Fig 3)

Caution: The diagonal distances thus verified must be equal, if not correct right angle turnings and arrive at equality between diagonals.

All the line threads must travel at same level and separated only by thickness of threads.

Use Builders square to turn and check the back right angle of thread line as shown in Fig a, b, c and d.

Check the diagonal of square or rectangle

Objective: This shall help you to
- **verify diagonal distance between profile markings.**

Steps

Tie thread lines between profiles to run on the center line mark.

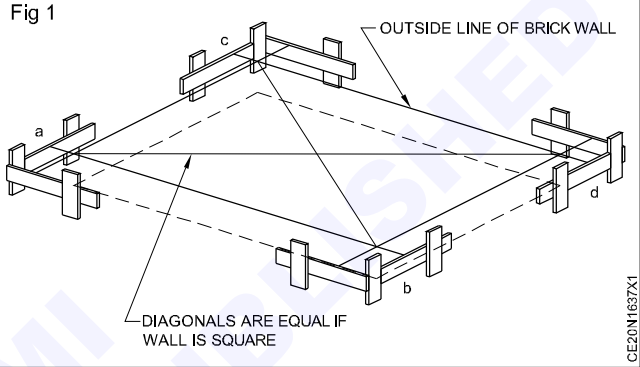
Obtain intersection points on the line thus stretched.

Measure the distance between diagonally opposite intersection points. (Fig 1)

The distance between two such pairs should be equal

Caution: If the two diagonal distance's are not equal, verify all right angles obtained at the intersection points and correct where necessary keeping any one line between two intersecting points as base not to be altered.

Fig 1



Set out a building - marking the center line layout of the building

Objectives: This shall help you to
- **produce center lines of the building on the profiles**
- **transfer center line mark, on the ground.**

Mark centre line in layout of the building

Trace center line plan of the building (Fig 1) and orientation of the building.

Tie all line threads at almost same level (Levels separated only by thread thickness) between pegs P1 P2, P3 P4, P5 P6 and P7 P8 (Fig 3).

Calculate half wall width ie 115mm plus the balance two meter = 2115mm for locating the center line pegs for the front wall of the building.

Measure this distance of 2115 mm on the line thread P3 P4 from the intersection point 'e' (Fig 3) and locate and drive peg P9.

Measure once again the distance 2115 mm from the inspection point e and locate the nail point on peg P9 and drive nail.

Repeat the process from intersection point f and locate peg P10 and drive nail.

Now tie line thread between P9 P10.

Mark a safe distance (say half a meter) in front of peg P9 towards the building and drive a profile.

Repeat the same procedure in front of peg P10 and drive another profile.

Mark the center line on these profiles.

Remove line thread P9 P10 and tie between these two profiles and obtain center line of the building front wall.

Repeat process to obtain all other center lines as per the center line drawing.

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Fixing tie line thread to nails

Objective: This shall help you to
- **tie line thread to nails.**

Steps

Form a loop in the line thread as shown in (Fig 1)

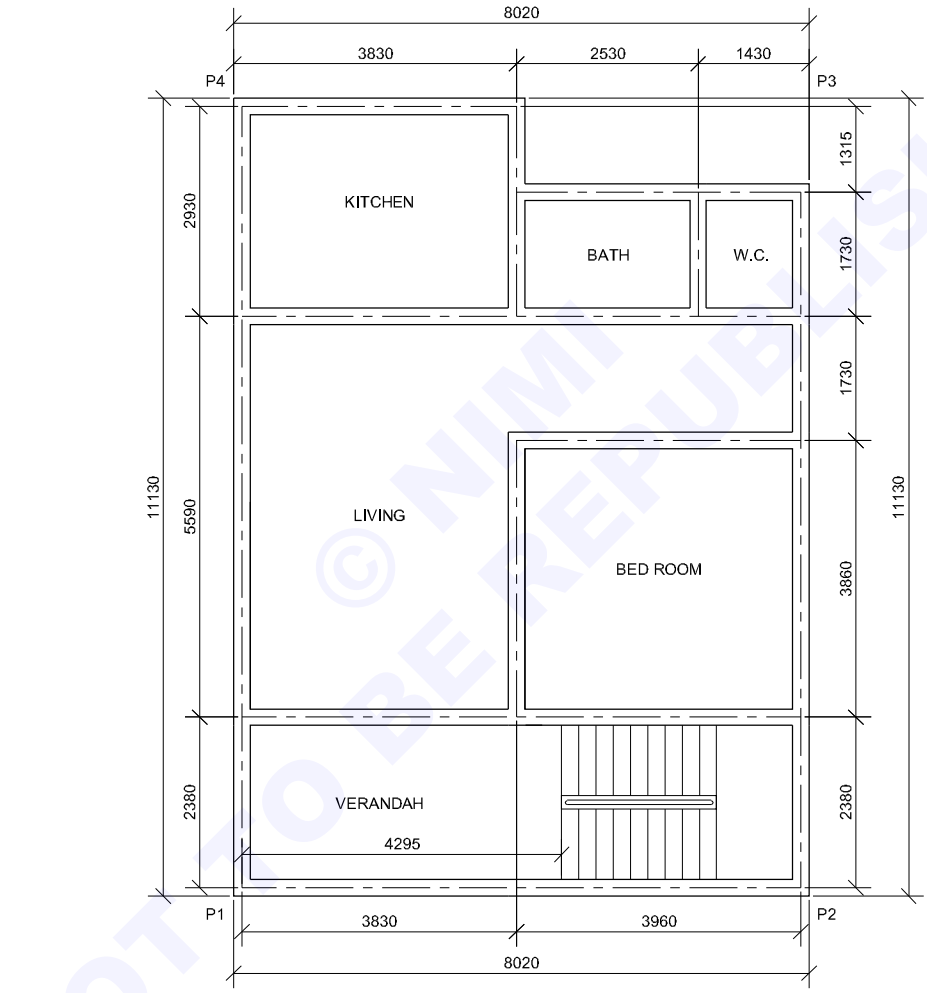
Hold the loop apart over the thumb and forefinger of the left hand and the bottom with the right hand and form a triangular shape

Turn the left hand downward, holding the thumb and forefinger together and this forms a loop around these two fingers.

Pull downward firmly with the right thumb and forefinger until the two loops have almost reached each other.

Push the loops on the nail and draw the loops tightly against the nail to form the tie.

Fig 1



NOTE:
1. ALL DIMENSION'S ARE IN MILLIMETER

CENTER LINE PLAN

CE20N1637Y1

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Fixing the profiles

Objective: This shall help you to
- **form and drive profiles.**

Steps

Use a hand saw, cut one end of the two vertical battens flat .

Measure the total length of the vertical battens and mark the one third length from the opposite end.

Use a hand saw, sharpen one third length to a conical shaped edge.

Nail the horizontal batten to the vertical batten keeping them apart .

Mark the points on the ground where the vertical batten have to be driven.

Position the prepared profile with the sharpened edge kept on the mark.

Use hammer and gently strike the first few blows on the flat edge of the vertical batten to drive the sharpened edge little into the ground.

Use plumb bob and check the verticality of the driven profile.

Tilt to the required side using the hammer if the profile thus driven is not vertical.

When the profile is vertical, strike a few hard blows with hammer on the flat surface followed by few gentle final blows to fix the profile to the required uniform horizontal level (use spirit level to check horizontal level)

Caution : All the profiles to be driven only up to the conical shape marking so that the profiles top shall be at the uniform height from ground level.

Marking the center lines on profiles

Objective: This shall help you to
• mark the center lines on profiles.

Steps

Tie the center line thread between pegs.

Allow thread lines to just pass over a flat horizontal batten top (Fig 1)

Plumb from the center line and make a vertical pencil mark on the horizontal batten side using plumb bob and tri square.

Use tri square on this vertical pencil mark, square it across the top surface of the horizontal batten and draw a pencil mark.

Slightly move the thread line by your hand, and using a hand saw make a dent say about 1mm thick on horizontal pencil line mark thus made

This dent thus formed constitutes the center line mark on the profile.

Allow the thread line to pass in the groove.(Fig 2)

Caution

- **Center line thread should be traveling free without any obstruction, twist and knot when tied between pegs.**
- **All horizontal battens of profiles to be truly horizontal and at same levels.**
- **All profiles should be located so that it will not be disturbed when foundation works in progress.**

Fig 1

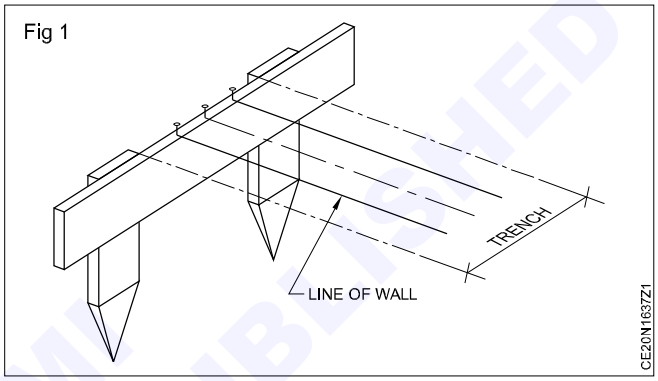
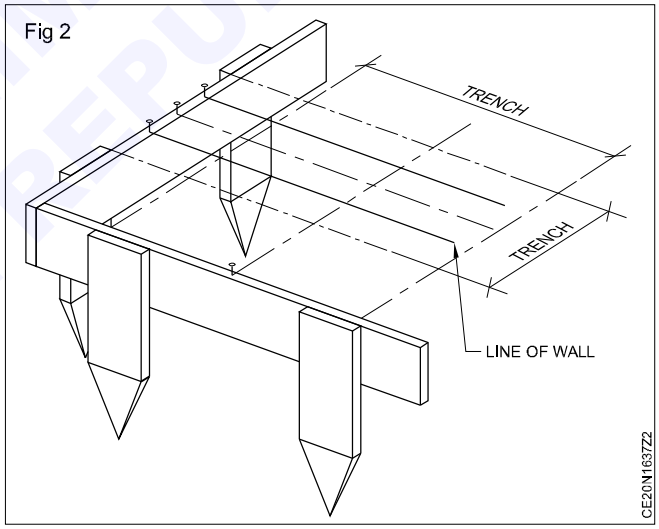


Fig 2



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Marking excavation lines and fixing of plinth and floor levels and Set out foundation trench

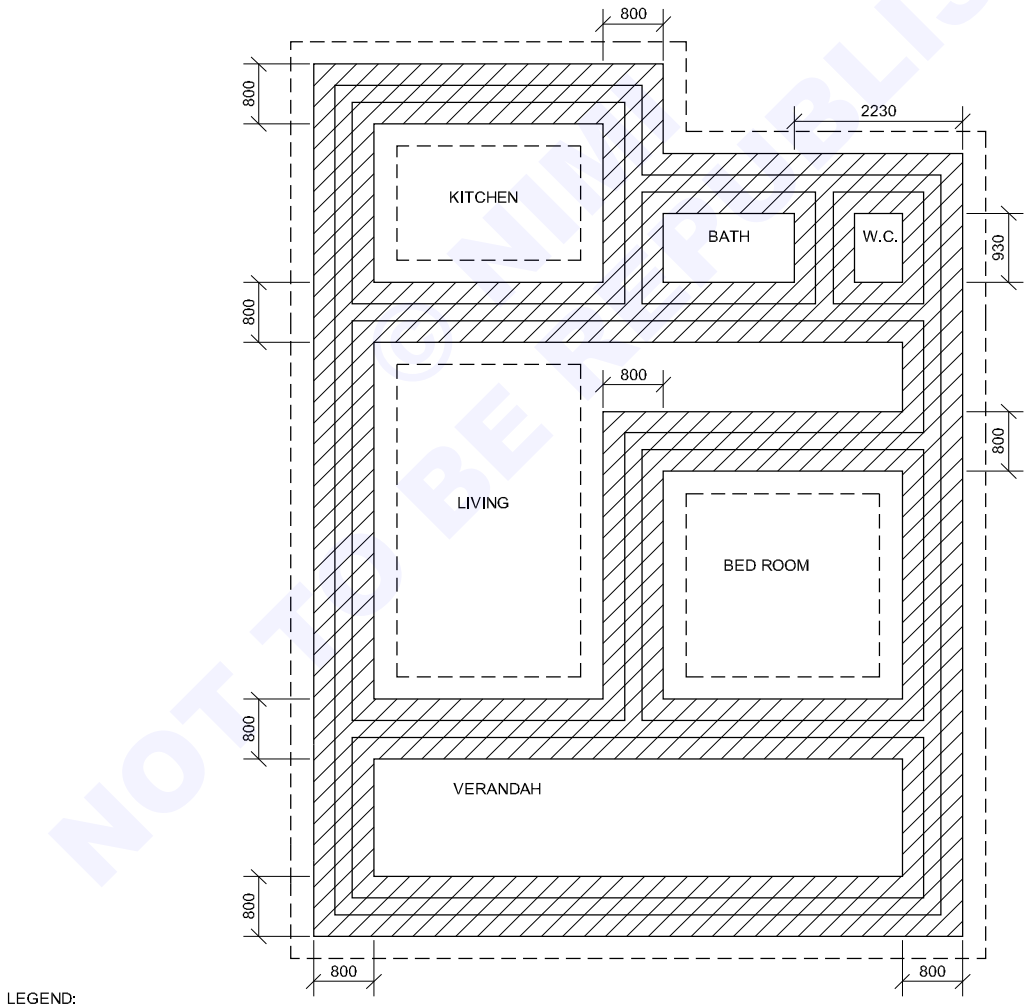
Objectives: At the end of this exercise you shall be able to
- **mark plinth level and height**
- **mark the edge of foundation and excavation on the ground**

PROCEDURE

TASK 1 **: Mark the plinth level and height**

- Trace plot a layout sketch and note bench mark level. (Fig 1 of Ex. No : 1.6.37)
- Trace foundation layout and note excavation depth
- Drive at a convenient location, a local permanent bench mark level peg.
- Transfer the required bench mark level and drive this peg so that the top of the peg is equal to the required level and treated as permanent bench mark.
- Transfer this level to all four corner profiles and have a reference level mark.

Fig 1



- Hold a straight edge to tally with this level and also to appear on the trench
- Measure down from this straight edge to get the required excavation depth/plinth level

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- Tie and stretch thread line between two opposite level pegs if length of straight edge is not enough.

Caution

Plumb for vertical measurements.

When transferring levels the water tube should be free from air bubbles, not twisted clear and readable and correct markings done.

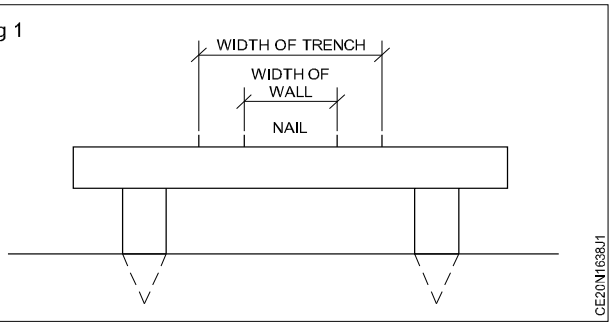
- Repeat this process at all four corners, and at intermediate points to get the required uniform plinth level.

— — — — — — — —

TASK 2: **Mark the edge of foundation and excavation on the ground**

- Study center line sketch Fig 1 of (Ex.no : 1.6.37)

Fig 1



- Study foundation cross section and foundation layout drawing and note excavation width.
- Tie and stretch thread line on the existing center mark between two opposite profiles.
- Plumb for vertical at thread line intersecting points.
- Drop plumb bob slowly and mark the point.(Fig 3)

Caution : When transferring the intersecting point the plumb bob must be held without shake and not disturbing the center line threads.

- Repeat this process at the opposite intersecting point.
- Stretch a thread line between these two opposite points on the ground.
- Pour lime powder on this line gently by using two fingers only.
- Remove thread line.
- The center line has been now marked on the ground.
- Measure one half of required width of excavation at right angles to this lime powder line at three or more point along the length and put lime powder dots.

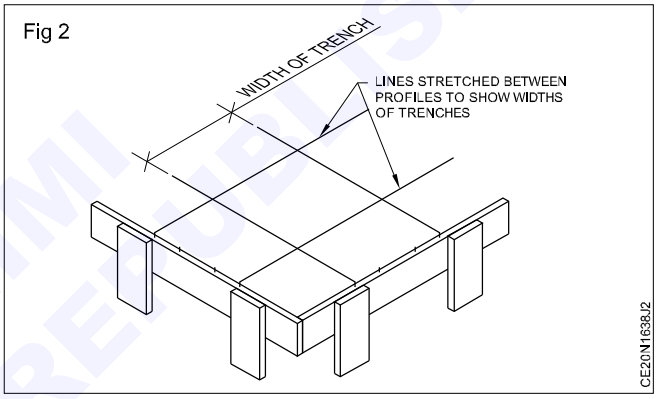
Caution : Width of foundation excavation to be calculated considering angle of repose for the type of soil, and also labour workability.

- Stretch a thread line to run on all these lime powder dots.
- Pour lime powder on this stretched line gently by using two fingers only.

Caution : Pouring lime powder on the thread must be done carefully, without shake

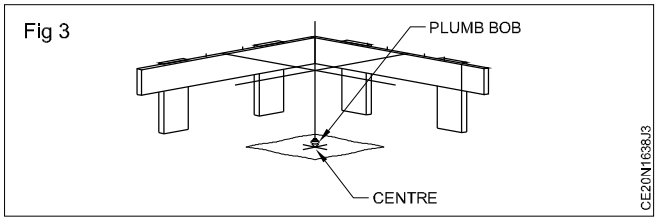
14 Remove thread line (Fig 2)

Fig 2



- The foundation excavation edge line on one side has been now marked on the ground.
- Repeat this procedure on the other side of ground center line for marking the other edge line.
- The width obtained between these two lines is the width of foundation excavation. (Fig 1)
- Repeat the process on all foundation locations to be obtained to such edge lines. (Fig 3)

Fig 3



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Skill sequence

Using water tube levels

Objective: This shall help you to
- **transfer levels between two points using water tube levels.**

Steps

- Fill water in the water tube

> **Note: This is usually done by having a bucket of water and allowing water to pass by gravity into the water tube. After putting one edge in the water and the other edge to siphon by lowering it down.**

- Hold water level mark of one edge of the tube totally with the permanent bench mark level
- Stretch the tube to reach maximum length and turn the opposite edge vertically up.
- Read the level when the other end mark is steadily tallying with the bench mark without any variation.
- Drive a peg and mark this level.
- Now this is the transferred bench mark level
- Repeat this process from this peg and proceed to transfer the level to reach the desired peg.

> **Caution**
>
> **Every time when levels are transferred make sure that there is not even a minute variation since each transfer is a potential source of a carry over error. Repeat the process of transferring more than once and make sure that the correct levels are transferred.**

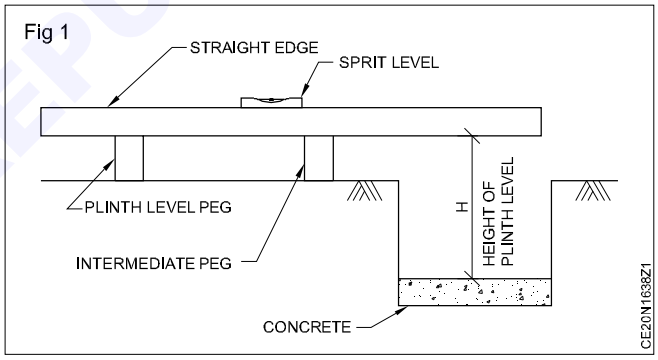
Measuring down from plinth level

Objective: This shall help you to
- **determine the height of courses upto plinth level.**

Determine the height of course not plinth level

- First check the reference point
- Verify the top surface of the pillar.
- Place the straight edge on the top of the plinth level peg and Reference point.
- Extend the straight edge to reach over the excavated portion as shown in (Fig 1)
- Level the straight edge by using spirit level or plumb level.
- Measure down from the under edge of the straight edge with steel rule (or) with foot rule, as the required distance (or) height.

Fig 1



- Check the level by recessing the straight edge and level.

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Demonstrate the use of brick masonry tools

Objective: At the end of this exercise you shall be able to
- **identify various brick masonry tools and their uses.**

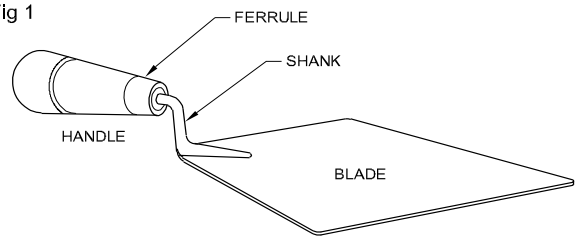
PROCEDURE

Note: Instructor should demonstrate the masonry tools to the trainees and its purposes, uses in masonry works.

TASK 1: **Trainees should identify the names of the tools visually or by means of chart**

TASK 2: **Trainees should prepare a table stating the name of tools and their uses (Fig 1 to 29)**

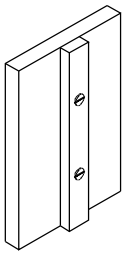
Fig 1



BLOCKLAYING TROWEL

CE20N1640H1

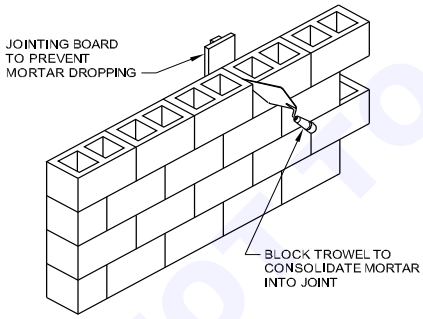
Fig 2



JOINTING BOARD

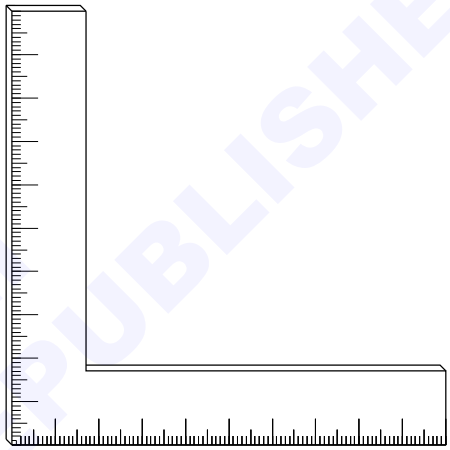
CE20N1640H2

Fig 3



CE20N1640H3

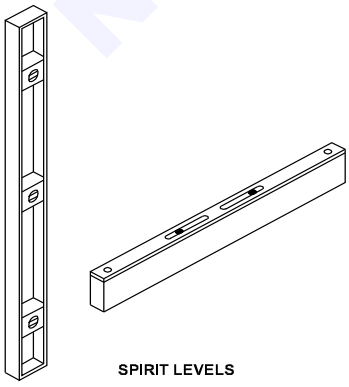
Fig 4



STEEL SQUARE

CE20N1640H4

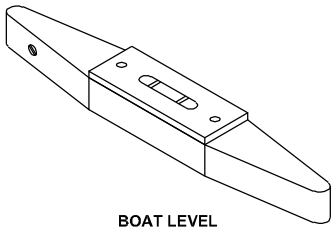
Fig 5



SPIRIT LEVELS

CE20N1640H5

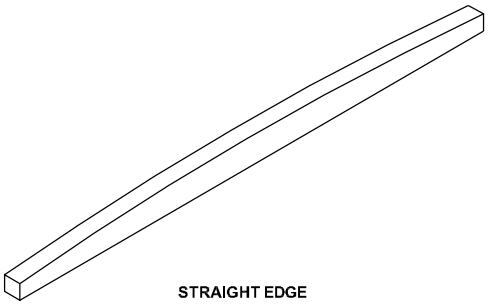
Fig 6



BOAT LEVEL

CE20N1640H6

Fig 8



STRAIGHT EDGE

CE20N1640H8

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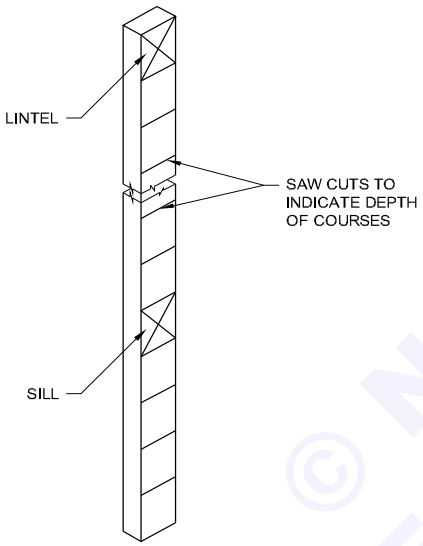
Fig 7



PLUMB RULE

CE20N1640H7

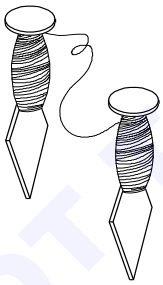
Fig 9



GAUGE RULE

CE20N1640H9

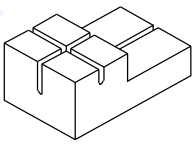
Fig 10



LINE AND PINS

CE20N1640HA

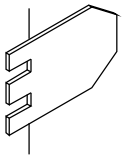
Fig 11



ENLARGED VIEW OF CORNER BLOCK

CE20N1640HB

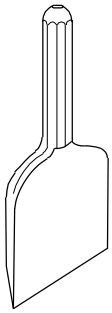
Fig 12



TINGLE PLATE

CE20N1640HC

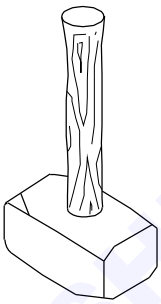
Fig 13



BOLSTER

CE20N1640HD

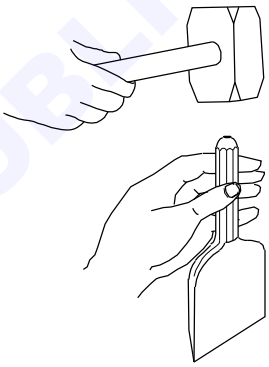
Fig 14



CLUB HAMMER

CE20N1640HE

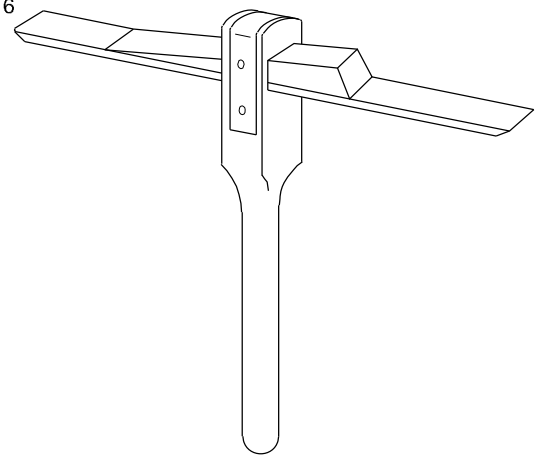
Fig 15



CUTTING WITH BOLSTER AND HAMMER

CE20N1640HF

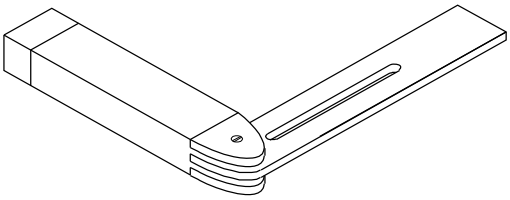
Fig 16



SCUTCH

CE20N1640HG

Fig 17

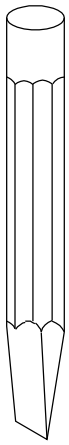


SQUARE AND BEVEL

CE20N1640HH

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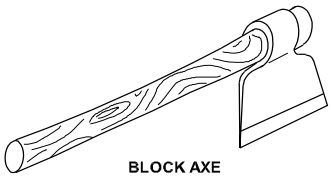
Fig 18



COLD CHISEL

CE20N1640HI

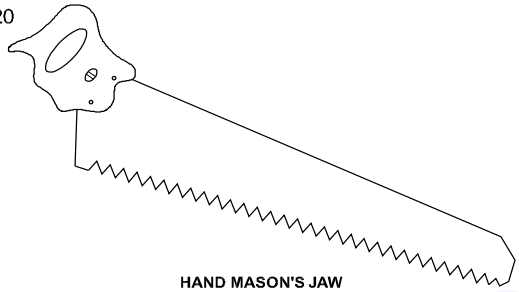
Fig 19



BLOCK AXE

CE20N1640HJ

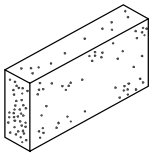
Fig 20



HAND MASON'S JAW

CE20N1640HK

Fig 21



CARBORUNDUM STONE

CE20N1640HL

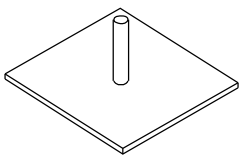
Fig 22



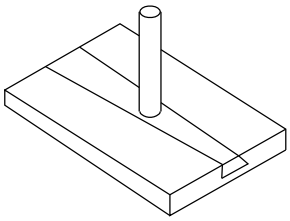
POINTING TROWEL

CE20N1640HM

Fig 23



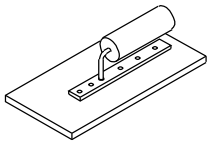
STEEL HAWK



WOODEN HAWK

CE20N1640HN

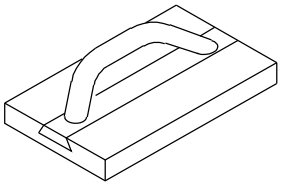
Fig 24



PLASTERING TROWEL

CE20N1640HO

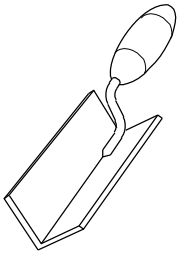
Fig 25



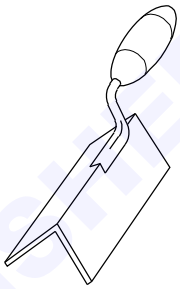
WOODEN FLOAT

CE20N1640HP

Fig 26



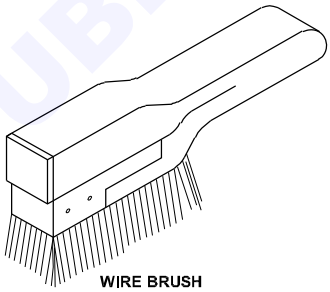
INTERNAL ANGLE TOOL



EXTERNAL ANGLE TOOL

CE20N1640HQ

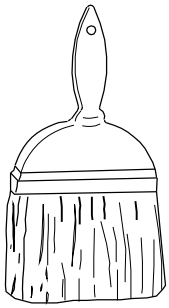
Fig 27



WIRE BRUSH

CE20N1640HR

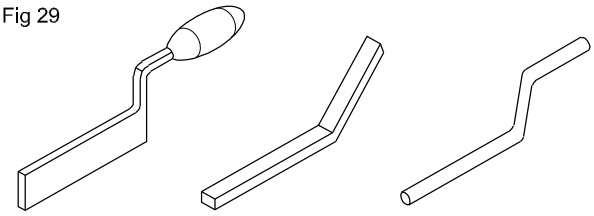
Fig 28



BRUSH

CE20N1640HS

Fig 29



JOINTERS

CE20N1640HT

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Different types of brick bonding

Objectives: At the end of this exercise you shall be able to
- **construction a wall header bond**
- **construction a wall stretcher bond**
- **construction a wall english bond**
- **construction a wall flemish bond .**

PROCEDURE

TASK 1: **Construction of a header bond wall (Fig 1) 200 mm thick**

1 Place required quantity of mortar in mortar pan and bricks.

2 Locate the face of the wall on the floor, mark a chalk line.

3 Prepare layout the first course with bricks and check.

4 Lay the bricks on the mortar bed align the level.

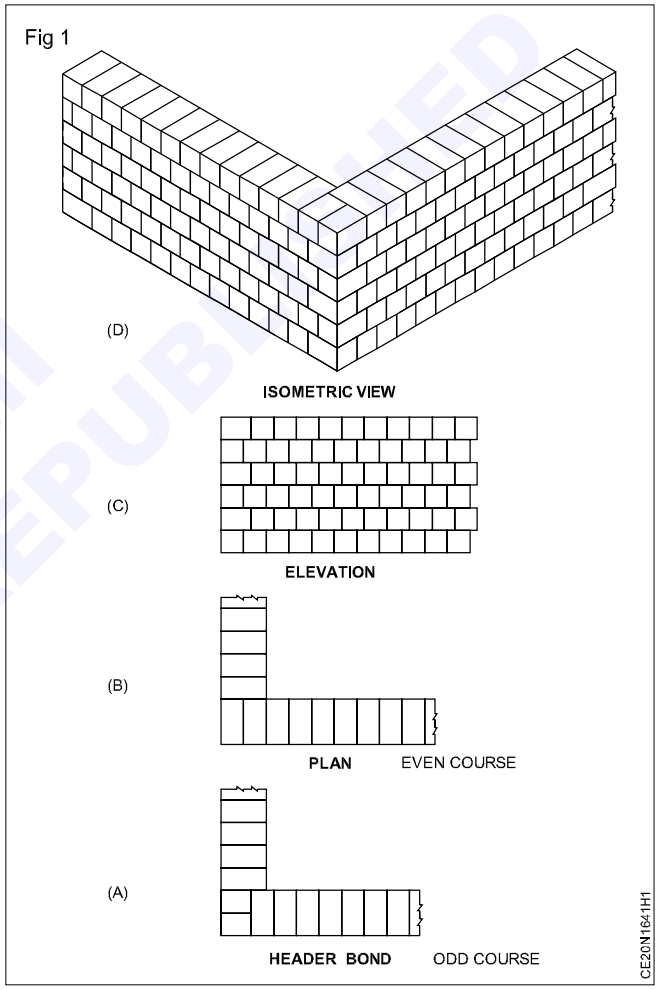
5 Lay the second course over the first course.

6 Complete the intersecting walls continuing alternate layout pattern in required.

7 Level and check plumb the wall (Fig 1)

8 Clean the wall by brushing with a brick layers brush.

Fig 1



TASK 2: **Construction of the wall in stretcher bond 100 mm thick**

1 Place required quantity of mortar in mortar pan and bricks.

2 Locate the face of the wall on the floor, mark a chalk line.

3 Prepare layout the first course with bricks and check.

4 Lay the bricks on the mortar bed align the level.

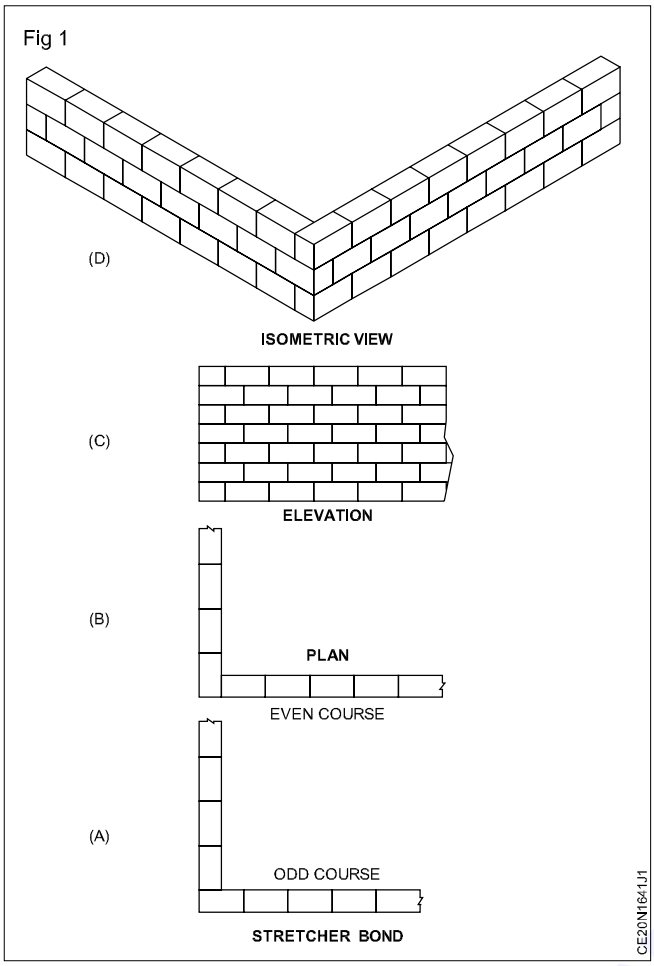
5 Lay the second course over the first course

6 Complete the intersecting walls continuing alternate layout pattern in required.

7 Level and check, plumb the wall (Fig 1)

8 Clean the wall by brushing with a brick layers brush.

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TASK 3: **Construction of english bond (one brick wall)**

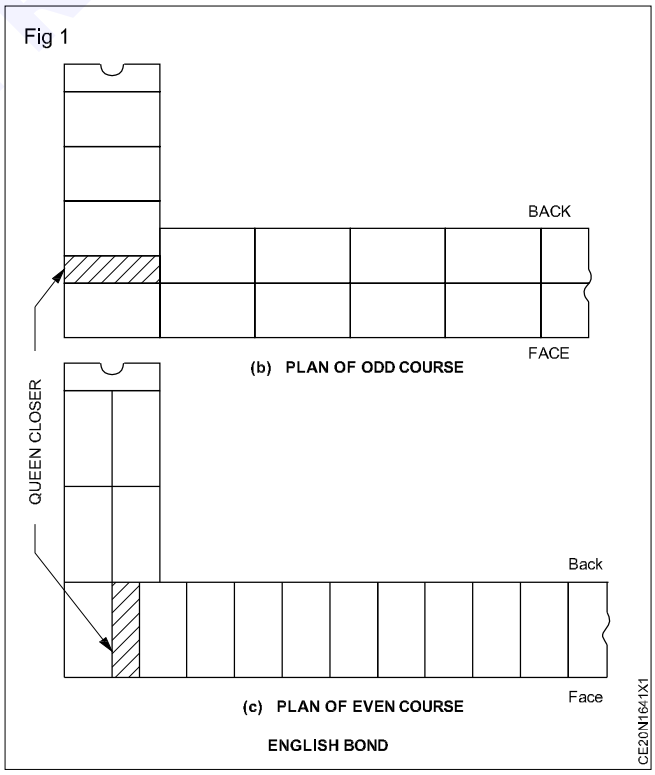
1 Locate the face of the wall on the floor, mark a chalk line.

2 Prepare layout the first course with dry bricks to identify and correct any problems by using line thread and also using straight edge.

3 Use the steel square.

4 Spread the mortar bed and lay the bricks and align, level and plumb the course of brick.

5 Lay intersecting brick wall and running the course to outside wall, align, level, plumb and check the thickness of brick wall (Fig 1)



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TASK 4: **Construction of a wall flemish bond (one brick wall)**

1 Locate the face of the wall on the floor, mark a chalk line

2 Prepare layout the first course with bricks and check.

3 Lay the bricks on the mortar bed and align the level.

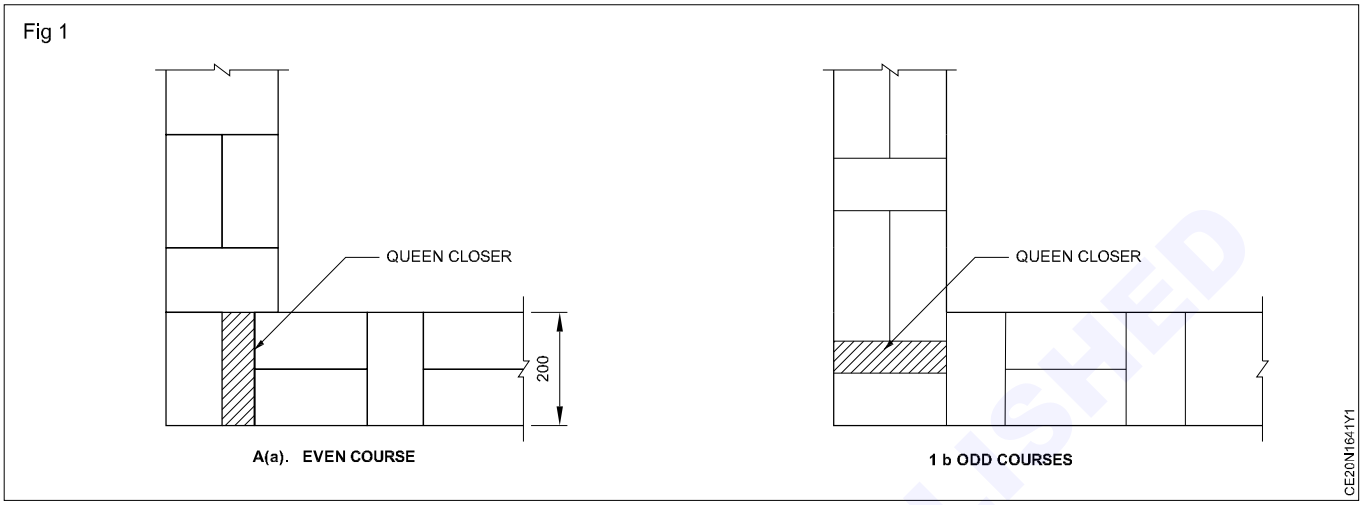
4 Lay the second course over the first course.

5 Complete intersecting walls continuing alternate layout pattern in ten courses

6 Level and check, plumb the wall (Fig 1)

7 Clean the wall by brushing with a brick layers brush.

Fig 1



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Make scaffolding and prepare surface for plastering

Objectives: At the end of this exercise you shall be able to
- **make scaffolding for exterior wall plastering.**

PROCEDURE

TASK 1: **Scaffolding for exterior wall plastering (single, double and needle scaffolding) (Fig 1 - 3)**

1 Inspect the wall for plastering

2 Measuring the height and width of exterior wall for plastering work.

3 Select the suitable scaffolding for exterior wall plastering work.

4 Check the ground capacity to support standards for scaffolding

5 Check the wall is to be freezed from traffic (in a case of ground is near to traffic area).

6 Use of ladder or trestle scaffolding up to height of 5 meters and it used for the light work and it is usually portable. This type of scaffolding is used for various purpose like for plastering and wall repair works.

7 Adjust the adjustable legs depend upon the wall height.

8 Before select the scaffolding system ensure the security, easy access and position advantage of scaffolding.

9 Install the scaffolding before start the wall plastering work.

10 Use the wood or steel scaffolding materials to support workers and other construction materials placed on it.

11 Maintain 1.5 meters vertical intervals during the construction of the wood or steel scaffolding.

12 Use the standard vertical posts.

13 Use the horizontal members parallel to the wall ledgers.

14 Use the bracing system for tight crimping.

15 Put legs whose both ends are supported on ledgers in double scaffolding

Fig 1

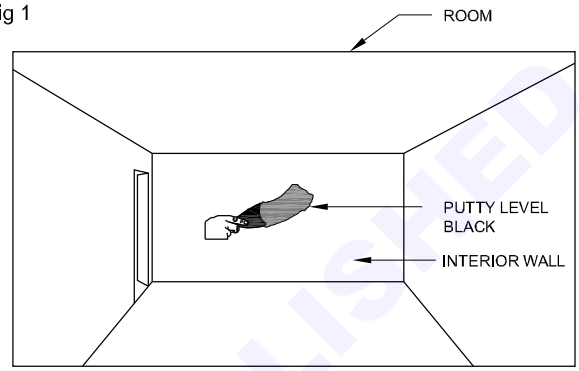
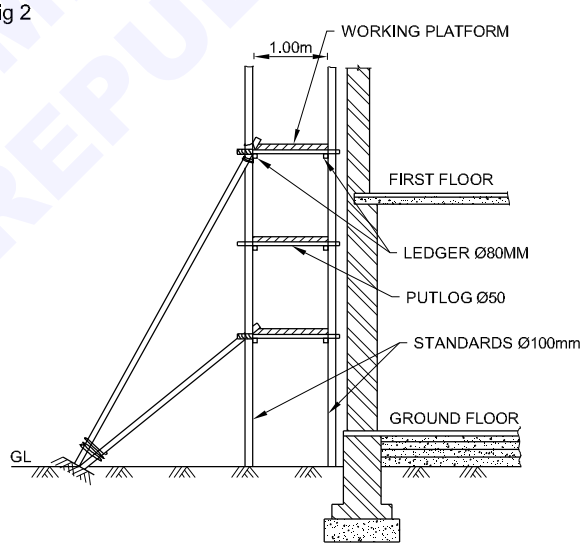


Fig 2



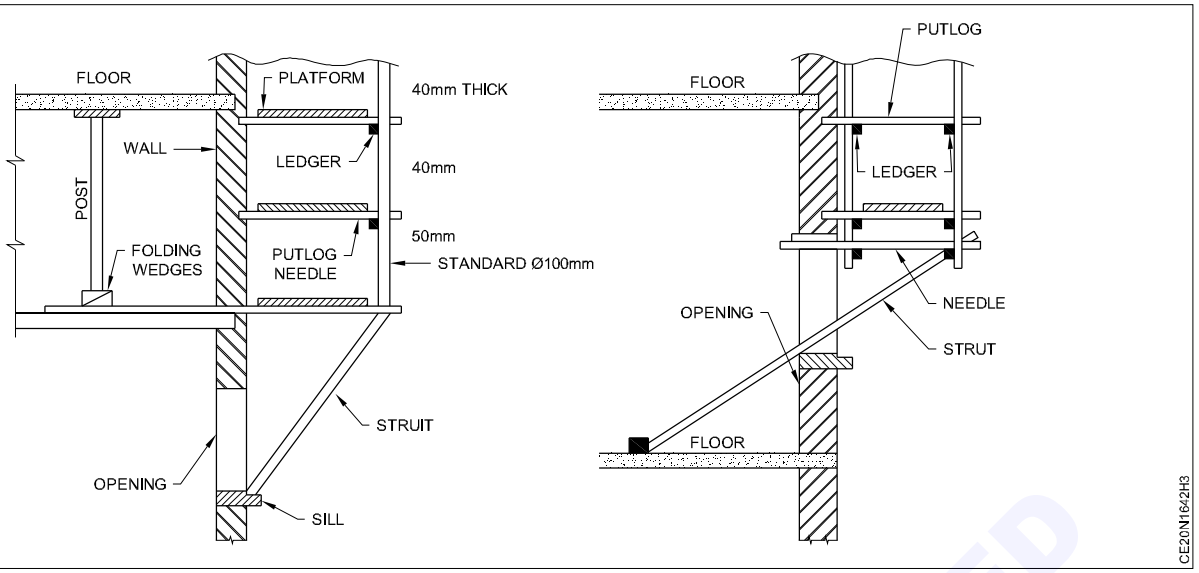
MASON'S SCAFFOLDING WITH RAKING SHORE

16 Planks should be strong for work man to stand on it.

17 Guard rail should be provided at about 1 meter level to. Guard the men working on the boarding.

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Fig 3



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Perform plastering operation on different surfaces

Objective: At the end of this exercise you shall be able to
- **perform plastering on different surface.**

PROCEDURE

TASK 1: **Erect scaffolding (Fig 1)**

1 Erect and make scaffolding work in advance, where the plaster is to be done.

2 Check the scaffolding carefully before starting plaster work.

3 Wooden planks and wooden vertical poles should not be old and weak to avoid probable accidents. (Fig 2)

4 Cleaned and kept wet before plastering is commenced.

5 Fill the gaps or holes in masonry and joints of wall and slab or beam etc should be filled up well with rich cement mortar 1:3

Fig 2

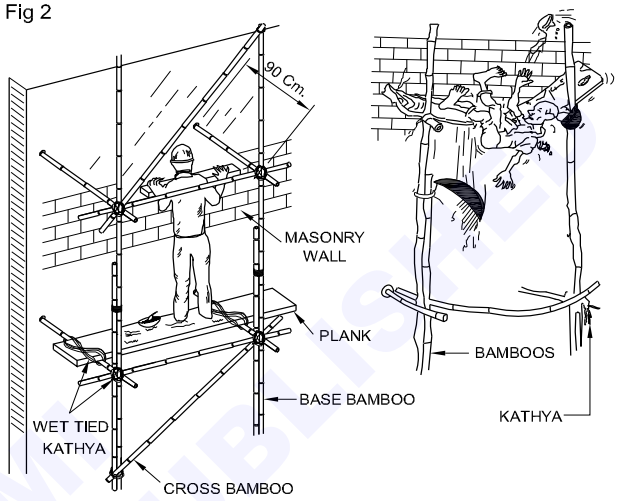
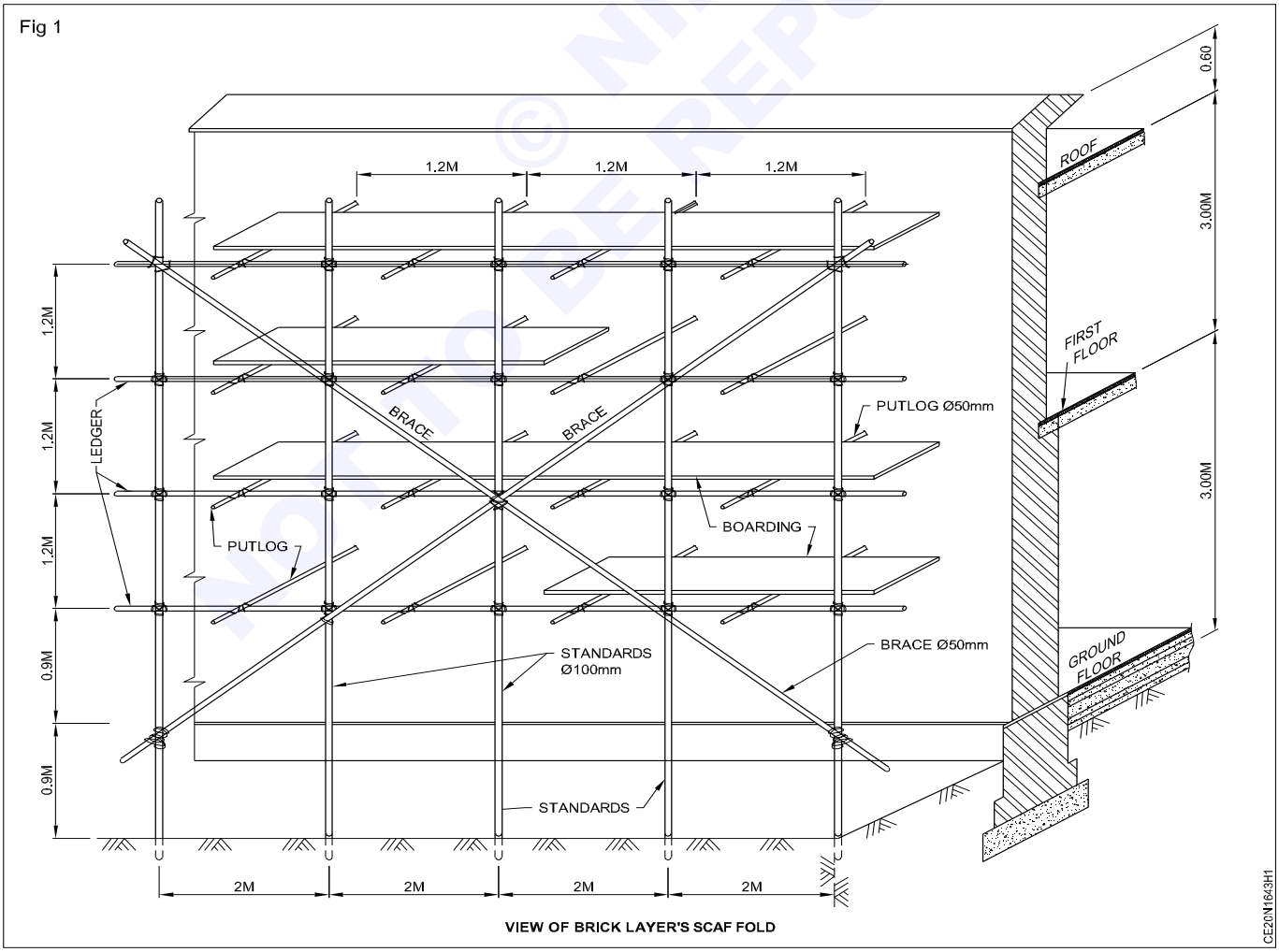


Fig 1

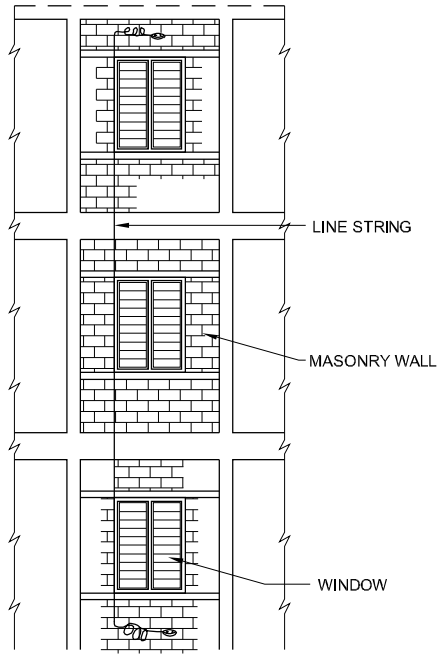


VIEW OF BRICK LAYER'S SCAF FOLD

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6 Check masonry work horizontally as well as vertically using line and thread from top to bottom at all the edges.

Fig 3



CHECKING OF WINDOW EDGES BY LINE STRING

CE20N1643H3

7 Fix the chicken mesh to all the joints of masonry and R.C.C work such as masonry wall, column and beam using by 'U' nails (Fig 4)

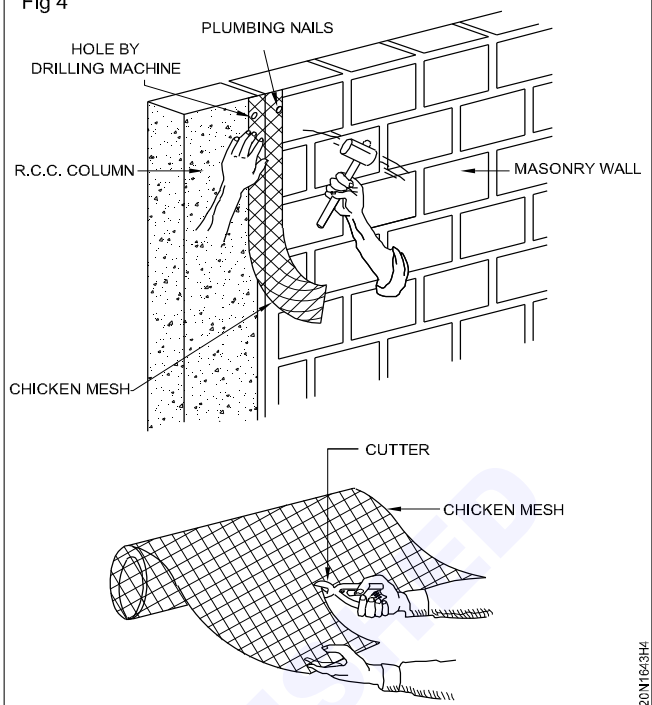
8 Wet the wall surfaces with fresh water in advance before plastering

9 Check all the windows, door frames for plumb, line and level (Fig 5)

10 Check the levels from the top of parapet wall to the bottom surface of masonry wall.

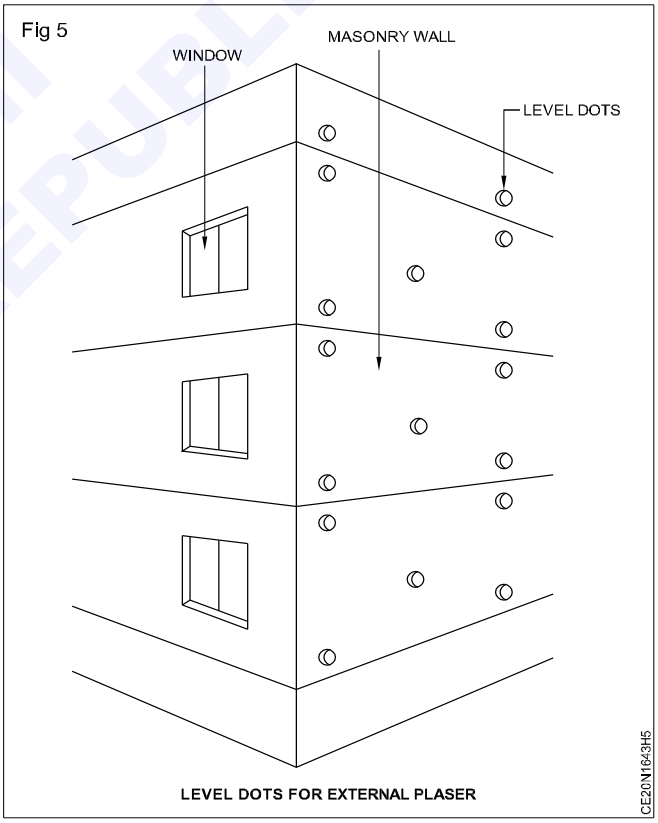
11 Fix the level dots or spot points 10cm x 10cm as specified thickness. (Fig 5)

Fig 4



CE20N1643H4

Fig 5



LEVEL DOTS FOR EXTERNAL PLASER

CE20N1643H5

TASK 2: **Apply external plastering**

1 Cement mortar dash against brick masonry wall between two level dots. just above the thickness required.

2 Tamped slightly by using small strip of wooden straight edge or by wooden float to ensure through filling of joints.

Then the surface brought to a true surface by working a wooden straight edge or Aluminium hollow section reach acrossing the level dots. This is called as a mortar screed.

Take care and see that no uneven surface is observed.

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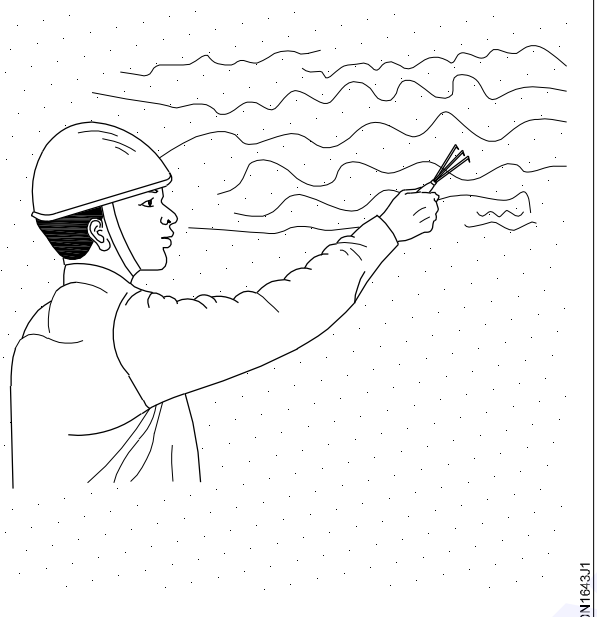
3 Repeat the process for another two level dots and the surface should be finished.

4 Laid or dashed the mortar on the wall between mortar screed.

5 Check the plaster surface with line and thread on respective level dots.

6 Make rough surface by wires for better bonding to second coat as shown in the (Fig 1)

Fig 1

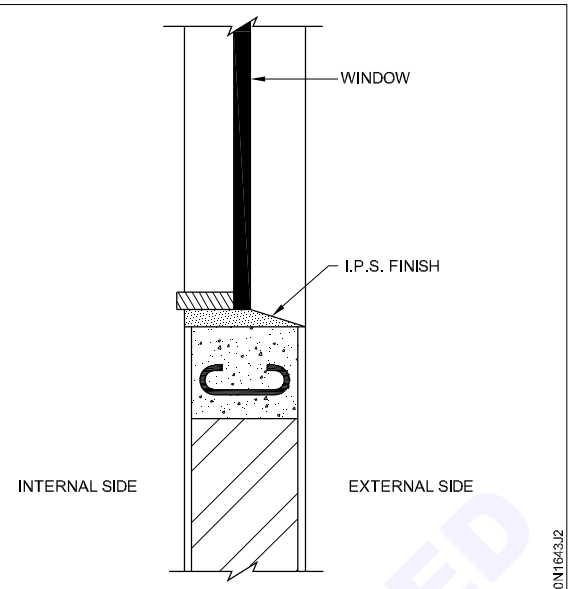


ROUGHNING OF PLASTER SURFACE

CE20N1643J1

7 Second coat of plaster is applied on the wall where the first coat is already applied.

Fig 2



FINISHING OF WINDOW SILL FROM OUTSIDE

CE20N1643J2

8 The thickness of two coats plaster is 18mm. ie first coat is 12mm thick and second coat is minimum 6mm thick

9 Use wooden straight edge to get uniform plain surface reaching across the level dots. with small upward and sideways movements at a time.

10 Finally the surface shall be finished off true with trowel or wooden float to get a smooth finish.

11 After the second coat, remove scaffolding step by step and fill the holes with mortar if any on the masonry wall.

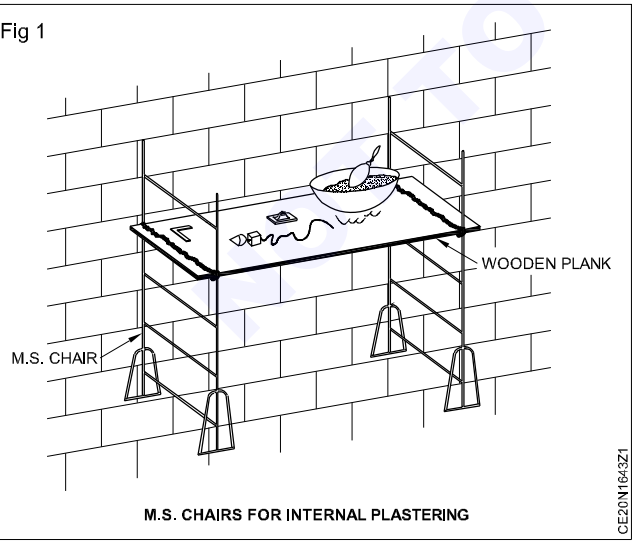
12 Clean all the surface of adjacent wall window and grills etc.

13 All the corners arises, angles and junctions shall be truly vertical or horizontal must be carefully.

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TASK 3 : **Make 6 mm R.CC slab ceiling plastering (Fig 1)**

Fig 1



M.S. CHAIRS FOR INTERNAL PLASTERING

CE20N1643Z1

1 Stage scaffolding provide for the ceiling plaster work.

2 Remove projecting burrs of mortar formed due to the gaps at joints in shuttering.

3 Clean the surface with wire brush.

4 Concrete surfaces to be plastered should be pock marked with a pointing tool, of spacings of not more than 5 cm centres.

5 The pock not less than 3 more deep, for a proper key for the plaster.

6 The surface of wall should be well wetted before the plaster is applied.

7 The mortar for ceiling plastering is 1:3 or 1:4 ie one part cement and three or four parts sand as specified in drawing or otherwise as directed.

8 Make even thickness and a true surface "level dots" are prepared (15cm x 15cm square)

9 Make level dots are 1.5 m intervals in both directions to serve as a guides for the plastering.

10 Make level dots are truly in the plane of the finished plaster surface.

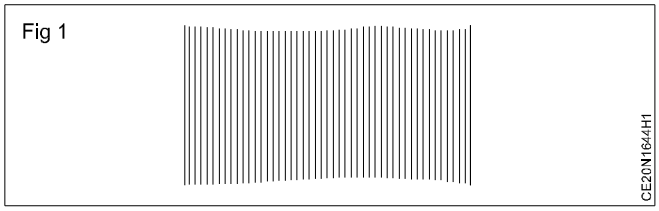
Perform rendering and wall cladding

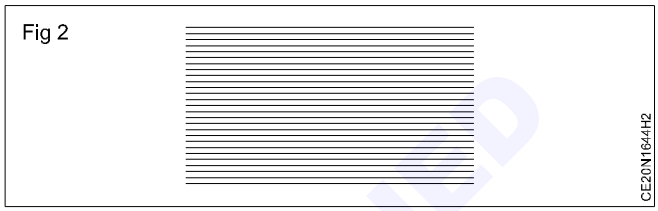
Objectives: At the end of this exercise you shall be able to
- **practice render the texture of an object**
- **practice bring the natural and appearing form in drawing.**

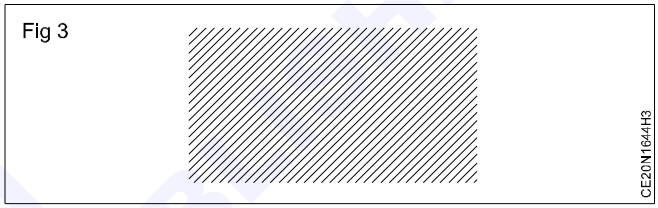
PROCEDURE

TASK 1: **Perform single tone rendering (to use it for shade)**

- Vertical lines (Fig 1)
- Horizontal lines - (Fig 2).
- Inclined\ by 45° angle (Fig 3).



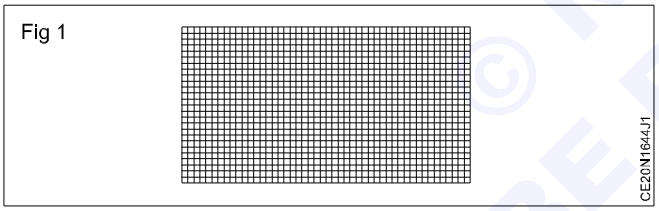


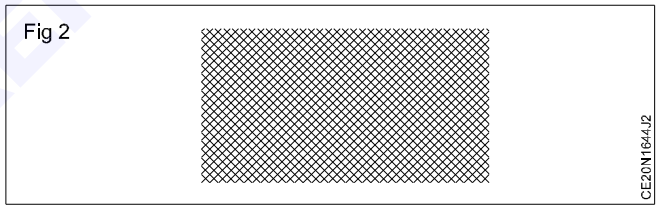


TASK 2: **Perform double tone rendering to use it for shadow**

Vertical and horizontal line distance of 1 mm (Fig 1)

Inclined/ do the line (Fig 2)



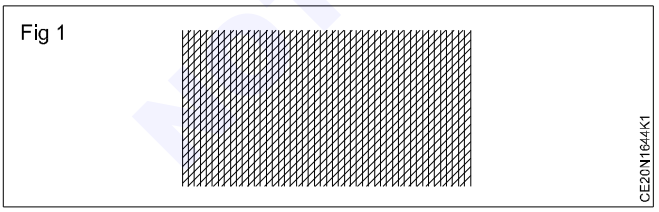


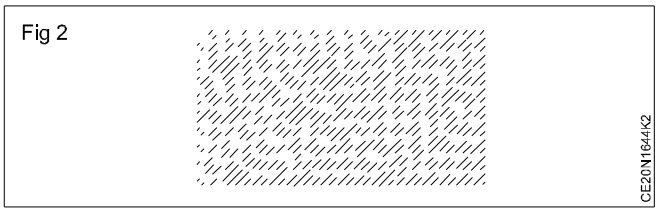
TASK 3: **Perform fabric rendering (Upholstery for sofa and curtains) (Fig 1 - 3)**

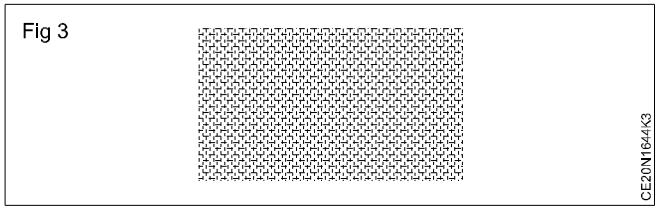
Rectangular - box

Inclined /do the line 1 mm 45° square

Vertical and horizontal do the line







TASK 4: **Perform carpet rendering**

1 Fill another three boxes of size 50mm x 25mm with different carpet texture.

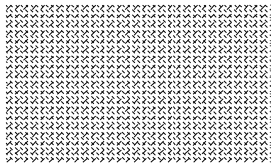
2 Dot technique used for carpet. (Fig 1)

3 Wavy pencil lines shown for carpet and sometimes used for fabric also. (Fig 2&3)

4 The free hand soft pencil vertical, inclined strokes used for carpet. (Fig 4)

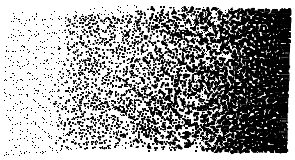
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Fig 1



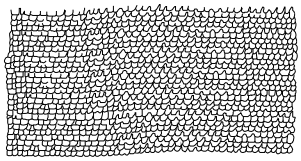
CE20N1644M1

Fig 2



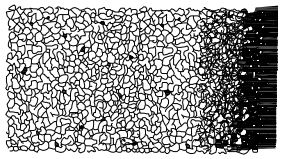
CE20N1644M2

Fig 3



CE20N1644M3

Fig 4



CE20N1644M4

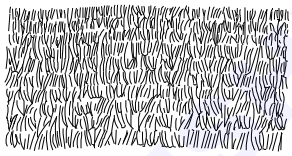
TASK 5: **Perform slopped Surface rendering**

For sloped surface

1 Fill the Box of 50x30mm size with horizontal lines starting distance of 3mm and should end with merging used for slopped plane.

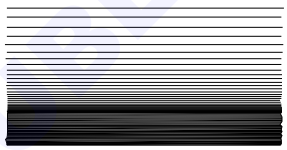
2 Fill the Box of 50x30mm with vertical lines wider at center and closer at the end of surfaces resemble cylinder or curve plane. (Fig 1&2)

Fig 1



CE20N1644N1

Fig 2

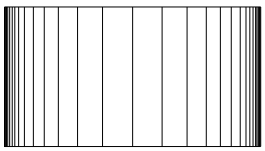


CE20N1644N2

TASK 6: **Perform building Materials Rendering**

1 Draw a rectangular box of size of 50mm x 50mm and fill with brick masonry. (Approx Brick size 20mm x 8mm) for brick work (Fig 1).

Fig 1

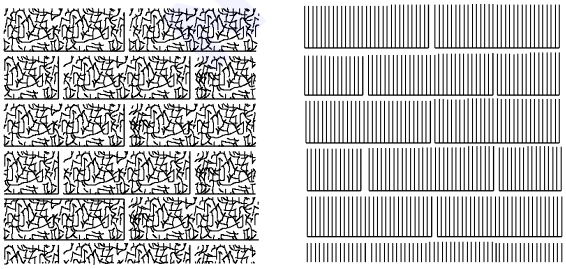


CE20N1644O1

TASK 7: **Perform Stonework rendering**

1 Render the rectangular box of 60mm x 50mm and fill with stone masonry. (stone size can be vary and follow the size of 25x25, 20x5; 1Ox10 1Ox15 etc) (Fig 1&2)

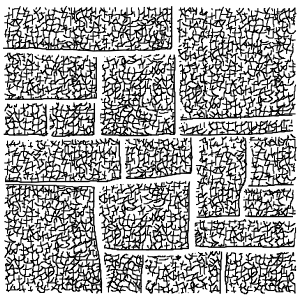
Fig 1



BRICK WORK

CE20N1644P1

Fig 2



STONE WORK

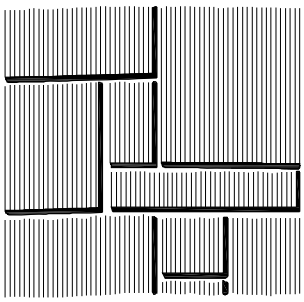
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TASK 8: **Perform timber rendering**

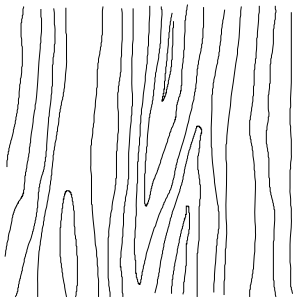
1 Draw a box size of 60mm x 50mm) free hand wavy lines for timber texture. (Fig 1&2)

Fig 1



CE20N1644U1

Fig 2



TIMBER

CE20N1644U2

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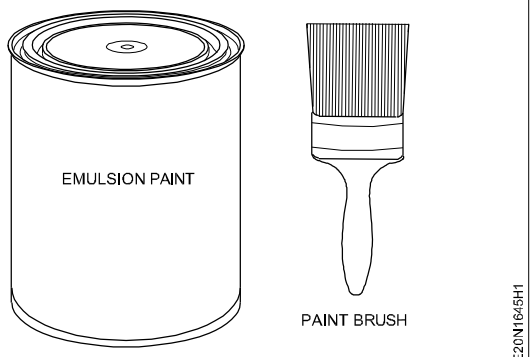
Perform application of cement paint on different surfaces

Objective: At the end of this exercise you shall be able to
- **application of cement paint on surface.**

PROCEDURE

TASK 1: **Cement paint painting procedure (Fig 1)**

Fig 1



1 Inspect the prepared wall for painting

2 Clean the wall before painting.

3 Select the paint material for painting

4 Select the painting brush for wall painting.

5 Prepare the cement paint as per instruction given on the paint packing.

6 Ensure the cement paint is ready for painting.

7 Prepare the scaffolding and set it near the wall.

8 Ensure the ladder or scaffolding is safe for working with paint.

9 Apply water on the wall to wet the wall surface.

10 Wet the brush tip on the water and clean the brush tip with clean cloth.

11 Wet the brush tip in paint and wipe brush tip to avoid the paint drops.

12 Start the painting from top and proceed towards the bottom side of the wall.

13 Apply paint by brush top to brush and bottom to top the paint brush stroke.

14 Ensure the paint brush stroke is evenly applied on the wall.

15 Cover the all walls with cement paint by brush stroke evenly.

16 Ensure the paint thickness is evenly applied on all walls.

17 Ensure the paint dry off time between paint coatings.

18 Ensure the even paint brush pressure while painting on the wall.

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Perform application of plastic emulsion on differents surfaces

Objective: At the end of this exercise you shall be able to
- **performing the application of plastic emulsion paint on different surfaces.**

PROCEDURE

TASK 1: **Application of plastic emulsion paint**

1 Clean the wall or ceiling surface.

2 Remove the loose particles, dust, dirt, grease, wax, mortar, dropping by using wire brush or knife.

3 Wipe off the wall/ceiling surfaces using a dry cloth.

4 If old painted wall, sand blast the wall, and scarp with the sand paper to get a smooth surface and wipe off the dust with dry cloth.

5 Apply prime coat before apply putty and allow it to dry

6 Apply wall care putty coat in a vertical bottom to top manner by using a putty blade.

7 Allow it dry for 6 to 8 hours.

8 After drying the first coat of putty, gently rub the surface with sand paper to remove the loose particle and uneven surface.

9 Start applying the second coat of wall putty.

10 Leave the surface to dry completely for 8 to 12 hours and rub the surface very gently to remove unevenness by using sand paper.

11 The minimum thickness of the coats should be limited to minimum 1.5 mm, if is thicker it may peel off or crack later on.

12 Apply the primer by coats to ensure a good bond between interior emulsion paint and surface to create a better finish. The primer provides the foundation for the paint job and increases the coverage of the paint.

13 Apply the primer by using brush or roller and leave it to dry. After 1st coat of primer apply second coat to and let it dry for 8 to 12 hrs.

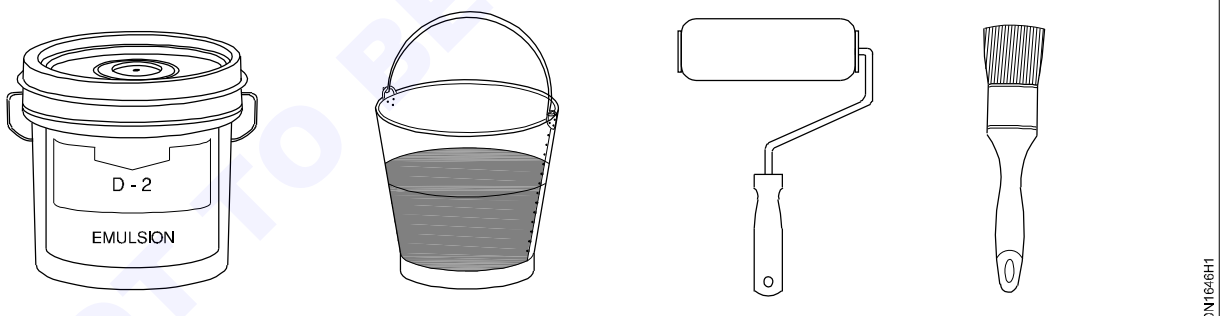
14 Ensure the primer and putty is applied properly on the ceiling and wall ready for painting process.

15 Dilute the interior emulsion paint as recommended by the manufacturer.

16 Apply the first coat of interior paint with help of brush or roller and allow it for dry as per manufactures instructions printed on the paint packing label.

17 Apply second and top coat paint as per your need.

Fig 1



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Perform application of enamel paint on different surfaces

Objective: At the end of this exercise you shall be able to
- **performing the application by enamel paint on different surfaces.**

PROCEDURE

TASK 1: **Application of enamel paint on different surface**

Before applying enamel paint on the surfaces to be painted the following operation and has to be carried on the surfaces.

Surface preparation

1 By using a wire brush or sand papers the surfaces is to be prepared.

2 The old paint coat should be removed by scrubbing with sand papers or wire brushes.

3 The surface should be free from non-uniformity.

Cleaning the surface

1 The scrubbed surface should be cleaned with cloth or by cleaning agent.

Preparation of enamel paint

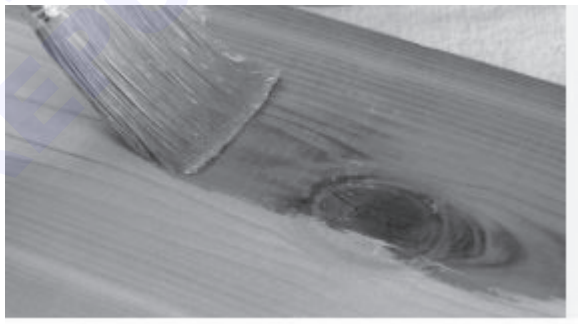
1 As per the manufacturer manual paint prepared by adding suitable amount of thinner.

2 Applying of enamel after the preparation it should be applied from top to bottom.

Apply of enamel paint on different surfaces

- Check the prepared surface for painting.
- Apply first coat of primer which acts as a filler and absorption well into the pores of wood and wall.
- Brush the primer well into the pores of wood and wall.
- After priming, fill up the nailed holes, cracks etc., with putty made by mixing whiting, with linseed oil to thick paste, with matching color.
- Allow over night to dry and use No. 130 sand paper to get a fine surface.
- Give a first coat of paint (Fig 1)
- Allow it dry for 48 hours.
- Finishing coat is applied straight from the tin and brushed (Fig 1)
- Finish the painting even and uniform and without any brush marks.

Fig 1



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Perform application Process of varnishing

Objective: At the end of this exercise you shall be able to
- **apply varnish on finished surface.**

PROCEDURE

TASK 1: **Varnish on finished surface**

- Clean all the wood surface using dusting brush.
- Rub the surface using dry cloth before varnish. (Fig 1)
- Prepare the brush for varnishing.
- Dip the brush with varnish.
- Apply the varnish using the brush on all over the surfaces uniformly. (Fig 1)

Fig 1



- Allow the first and second coat of varnish to dry.
- Apply the varnish with full brush evenly with short light strokes.
- Apply the varnish vertical should be crossed and re-crossed and then loid off lightly.
- It should be completed with upward brushing so that varnish could set flow down and eliminate brush marks.
- Apply the varnish horizontally in every direction with light quick strokes.
- It should be finished in one definite direction so that it could set without showing brush marks.
- Apply the varnish final coat
- The finished surface should present to look like fine glossy surface. (Fig 2)
- Avoid forming same or air bubbles.
- Surface should be rubbed down after each coat with firesand paper except final coat

Fig 2



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Perform on laying of D.P.C and materials

Objectives: At the end of this exercise you shall be able to
- **perform details of damp proofing in basement and external wall**
- **perform details of damp proofing in internal walls and cavity wall.**

PROCEDURE

Instructor shall display and demonstrate to the student regarding the perform laying of D.P.C with proper methods and materials.

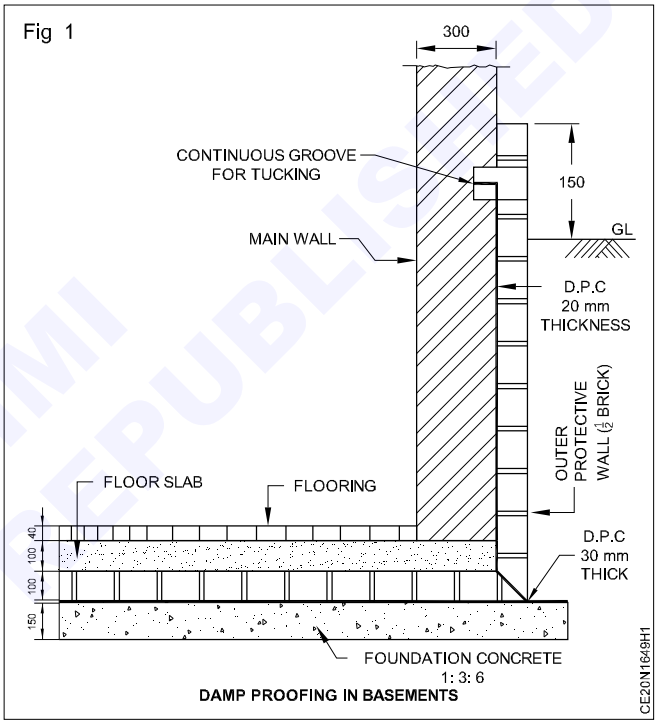
TASK 1: **Perform the details of damp proofing in basement (Fig 1)**

Data

- Thickness of main wall-300 mm
- Thickness of horizontal D.P.C.- 30 mm
- Thickness of vertical D.P.C.- 20 mm
- Thickness of foundation concrete-150 mm
- Thickness of brick wall-100 mm
- Thickness of floor concrete-100 mm
- Thickness of flooring-40 mm

1 the section of foundation of concrete is 200 mm.
2 horizontal D.P.C. of thick 30mm.
3 vertical outer protective wall of ½ brick thick.
4 vertical D.P.C. of 20 mm thick up to 150 mm above ground level.
5 100 mm thick brick layer over D.P.C.
6 100 mm thick floor concrete over brick layer.
7 vertical main wall of 300mm thick.
8 flooring above the floor concrete.
9 Show the proper conventional symbols and mark the important parts.

Fig 1



DAMP PROOFING IN BASEMENTS

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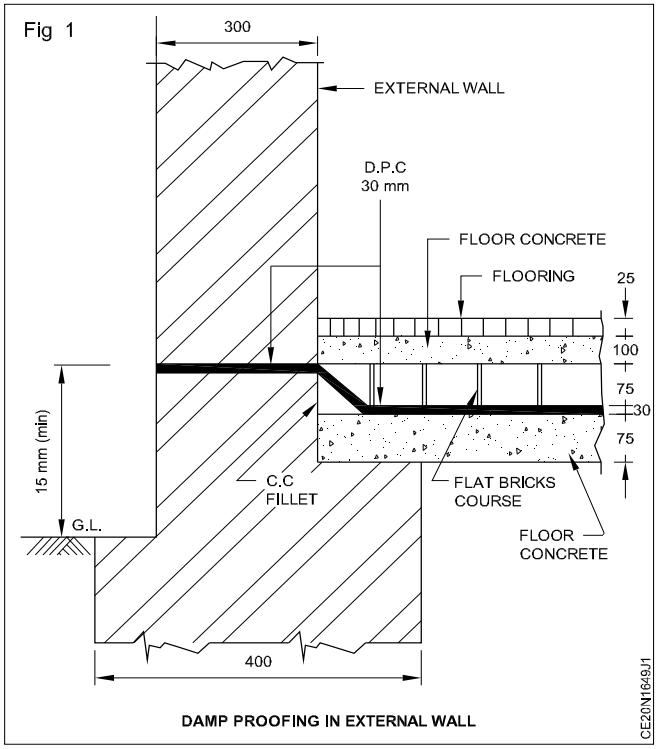
TASK 2: **Perform the details of damp proofing in external wall (Fig 1)**

Data

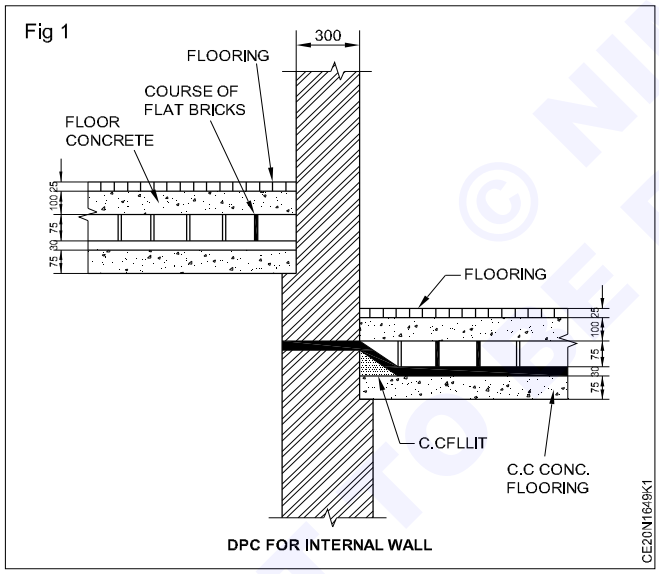
- Wall thickness-300 mm.
- Depth of lean concrete-75 mm.
- Thickness of flat brick-75 mm
- Thickness of D.P.C.-30 mm.
- Thickness of floor concrete-100 mm
- Thickness of flooring-25 mm

1 The section of wall and basement.
2 75 mm thick lean concrete.
3 30 mm thick D.P.C. over lean concrete.
4 75 mm thick brick course over D.P.C.
5 100 mm thick floor concrete over the layer of bricks.
6 25 mm thick flooring over concrete layer.
7 Show conventional symbols and mark the parts.

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TASK 3 : **Perform details of damp proofing in internal wall (Fig 1)**



1 Two ground floors at different levels are connected by an internal wall

Data

- Same as in Ex.2
- For drawing lower floor, procedure is same as in Ex.2.
- For drawing higher floor, show the floor at some height above the lower floor as shown in figure.

The D.P.C in the internal wall is in level with lower floor level.

Methods of damp proofing in roofs

Objectives : At the end of this exercise, you shall be able to
- **details of damp proofing in flat roof and parapet wall**
- **details of damp proofing by mud phuska terracing with tile**
- **details of damp proofing in pitched roof.**

TASK 1 : **Perform the details of damp proofing at the junction of flat roof and parapet wall (Fig 1)**

1 The section of wall 300 mm thick, with coping as shown in figure 1.

2 The R.C.C slab of 100 mm thick, at suitable level within the wall.

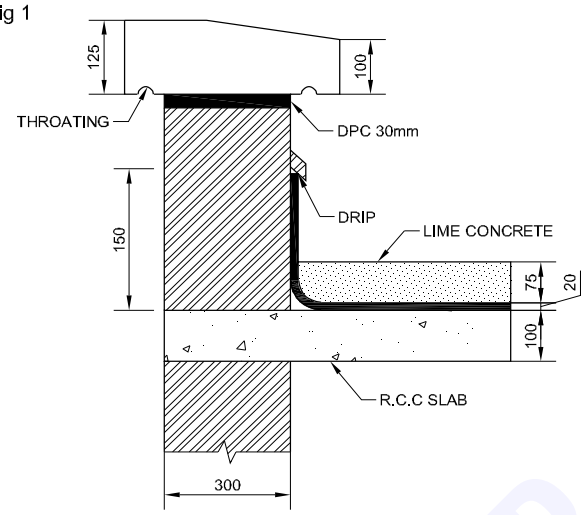
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3 D.P.C of 30 mm thick on the roof slab and 20mm at the side of parapet wall, to a height of at least 150mm.

4 75 mm thick lime concrete over D.P.C.

5 D.P.C below coping and complete the drawing as shown in figure 1.

Fig 1

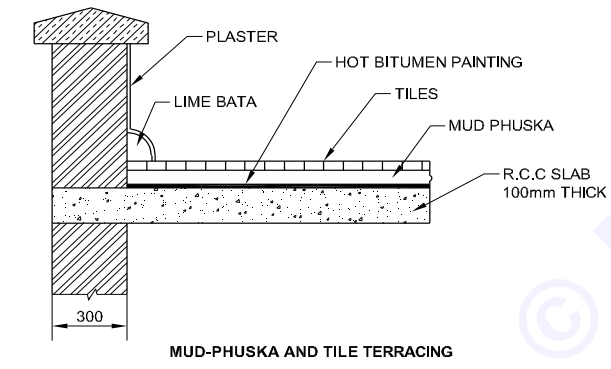


METHOD OF PROVIDING D.P.C IN FLAT ROOF AT THE COPING WALL AND ROOF JUNCTION

— — — — — — — —

TASK 2: **Perform the details of damp proofing by mud phuska terracing with tile (Fig 1)**

Fig 1



MUD-PHUSKA AND TILE TERRACING

1 Section of wall and slab.

2 A line to show the bitumen spray, over the slab.

3 Mud phuska terrace 80 mm thick over the bitumen layer.

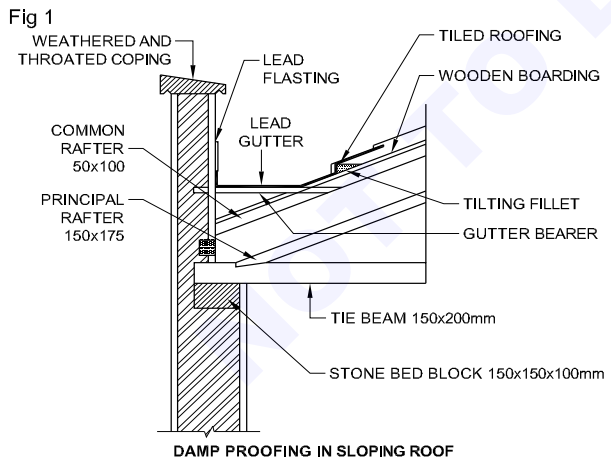
4 Tiles over 13 mm thick mud mortar.

5 Lime/cement concrete at the junction of paved tiles and side of parapet as shown in figure 1.

— — — — — — — —

TASK 3: **Perform the details of damp proofing in pitched roof (Fig 1)**

Fig 1



DAMP PROOFING IN SLOPING ROOF

Data

- Wall thickness-300 mm
- Stone bed block-150 x 150 x 100 mm
- Main tie beam- 150 x 200 mm
- Principal rafter-150 x 175 mm
- Common rafter-50 x 100 mm
- Purlin-100 x 175 mm
- Battens-50 x 30 mm
- Pitch of roof-30^0

1 Section of wall.

2 The stone bed block.

3 Main tie beam.

4 Principal rafter at an angle of 30.

5 Cleat and purlin over the principal rafter.

6 Common rafter at a distance of 150 mm above the principal rafter.

7 Tiled roofing over battens.

8 Show lead gutter over the bearer as shown in figure.

9 Shows lead flashing which extend to the vertical face of the wall and stop inside the wall.

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Flooring practice determination and formation of slope, application of slurry for finishing, setting out of skirting, formation of spots for skirting

Objectives: At the end of this exercise you shall be able to
- **determine the formation of a slope of floor in building**
- **make the top edges of skirting in perfect straight line**
- **apply mortar and lay tiles/floor.**

PROCEDURE

TASK 1: **Determination and formation of final slope of floor level**

1 Check the sub grade surface level of room.

2 It the level in not correct make it correct by cutting & filling and level it (or) compact it.

3 Mark the base line around the room, just 30cm above the sub grade of floor level by using tube level.

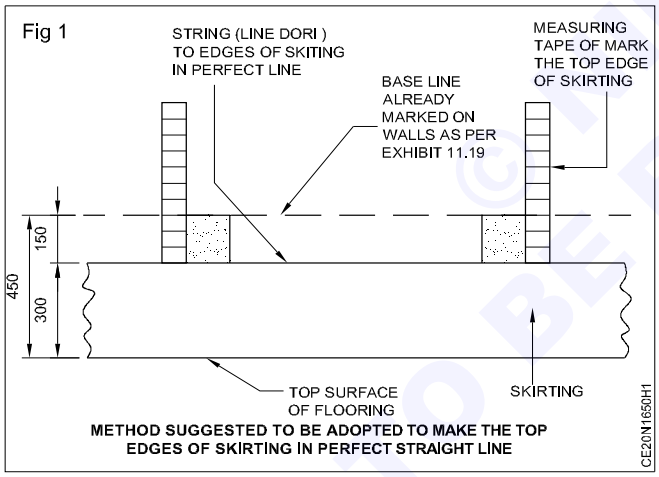
4 By using tube level mark the floor (Finished) level from the base line with a slope of 1: 200 to required corner/ side of the room.

5 With respect to the final/ finished floor level proceed for floor work after completion.

TASK 2: **Determination and formation of final slope of floor level**

1 Mark the position of the top of the skirting by measuring the distance between the base line and the top of skirting with measuring tape as shown in (Fig 1).

Fig 1



METHOD SUGGESTED TO BE ADOPTED TO MAKE THE TOP EDGES OF SKIRTING IN PERFECT STRAIGHT LINE

Note: A template should be prepared by using wooden batten shown in (Fig 2).

2 Fix the skirting tiles with the base line mark and also with the help of using wooden template projecting 10mm to 12mm only from wall plaster as shown in (Fig 2).

3 Fix skirting tiles at two ends of wall with wooden template projecting only 10mm to 12mm outside of the wall plaster as shown in (Fig 1).

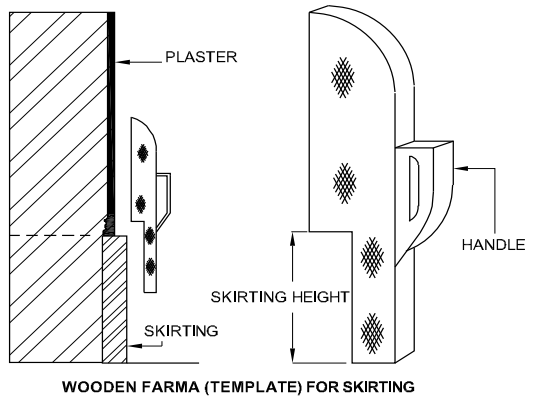
4 Fix the skirting tiles in between the reference tiles already fixed above.

5 Check the skirting tiles always that they should be projecting only 10mm to 12mm from wall plaster

6 Keep the skirting top line should be in one line, straight and in uniform level.

7 Fix the string line at two corners and again fix string line as guideline for all other skirting tiles.

Fig 2



WOODEN FARMA (TEMPLATE) FOR SKIRTING

TASK 3: **Apply mortar and lay tiles**

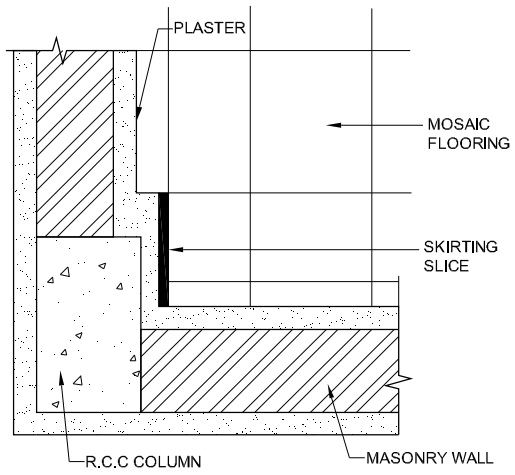
- Lay and fix accordingly to the reference line fixed as shown in (Fig 1).

Note: At the column positions skirting needs cutting/slicing in vertical direction. This will be carefully worked for keeping 10mm projections from the wall plaster as shown in (Fig 1).

- Mark both the sides of internal masonry walls provided and stretched with clear margin to accommodate skirting as shown in (Fig 2).
- For skirting of outer wall, pieces of skirting should be adjusted in the corners where furniture work is expected as shown in (Fig 3)

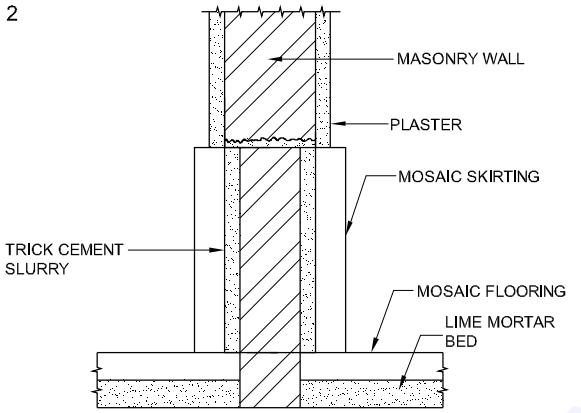
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Fig 1



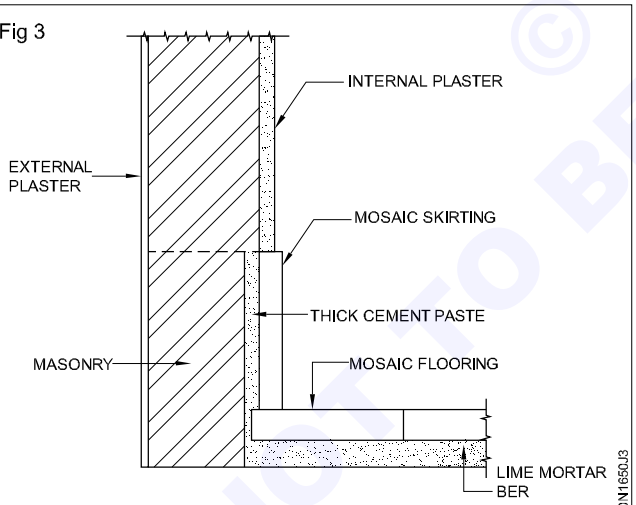
FIXING OF SKIRTING SLICES

Fig 2



INTERNAL WALL SKIRTING DETAILS

Fig 3



M.S. CHAIRS FOR INTERNAL PLASTERING

- Check top edges of skirting should be kept in perfect alignment.

Note: The width of offset of the skirting from the plaster surface of masonry wall should be perfectly uniform and in straight line.

The setting of skirting tiles should be in perfect plain.

The surface of the skirting should be made in perfect plain.

After curing of skirting the surface is polished.

The skirting tiles polishing should be done manually along with polishing of floors with same carborundum stones.

For 1st coat with 60No stone 2nd coat is done as grouting with cement slurry grey or white cement mixed with pigments to suit colour of the tiles.

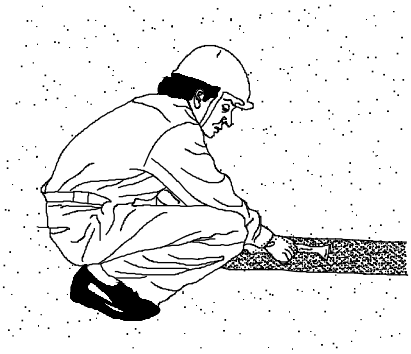
3rd coat is done with 120 No. Stones, these stones are finer than 60No. Stones.

4th coat is done with 320 No or 220 No. Stone purpose being smooth polish as shown in Fig 4.

After polishing is completed the surface of skirting washed with oxalic acid or powder form

Finally wash with water should be cleaned with wooden rage or smooth white brush.

Fig 4



HAND POLISHING TO SKIRTING

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Use of screeds, formation of curve at junction of skirting and floor

Objective: At the end of this exercise you shall be able to
- **form skirting in floor.**

PROCEDURE

TASK 1: **Form skirting in floor**

1 Mark the skirting top level line in wall just above 10cm from floor level around the room, as stated in previous Ex. No: 1.6.44, by using line and pins.

2 Mark the bottom skirting line in floor just 5cm away from wall.

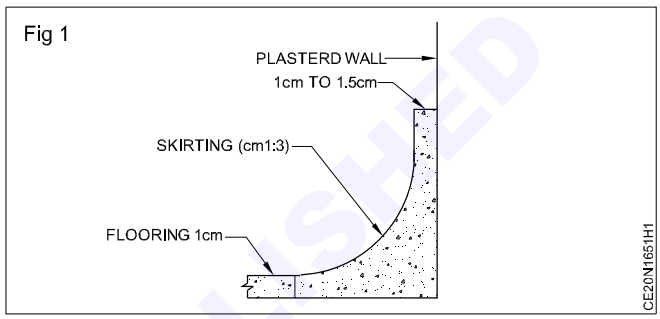
3 Clean the skirting area between the top and bottom level marking line.

4 Apply cement mortar (sieved sand should be used) 1:3 in skirting area as shown in (Fig 1).

5 Use the curved trowel to turn the curve.

6 The skirting surface area is finally brush finished with cement powder sprinkled with water for fine finishing.

Fig 1



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Practice on unfolding, stretching and folding of metric chain

Objectives: At the end of this exercise you shall be able to
- **unfold a metric chain to start the work**
- **drag and stretch the chain in line**
- **fold the metric chain after completing the work.**

PROCEDURE

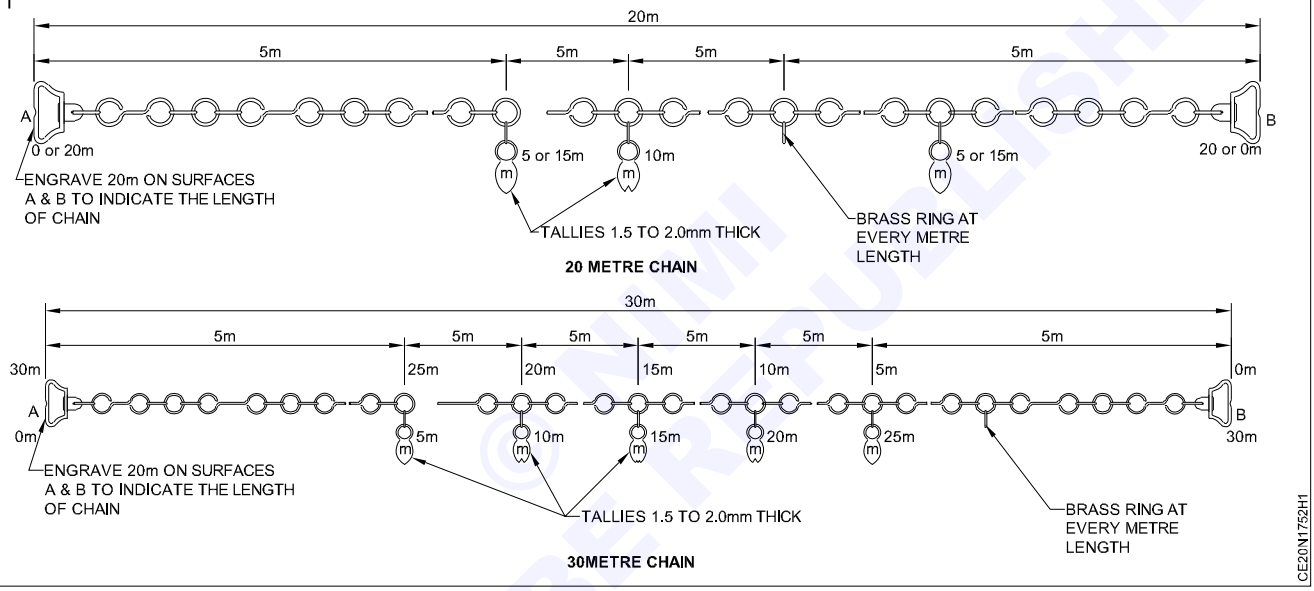
TASK 1: **Unfold a chain (Fig 1)**

1 Remove the leather strap from the bundle of chain.

2 **Follower:** Take both the handles of the chain in left hand and throw the chain well forward with right hand.

3 **Leader:** Take one handle of the chain and move forward until it extends to its full length.

Fig 1



— — — — — — —

TASK 2 : **Drag and stretch the chain in line**

1 **Follower**: Keep the heel at one end of the handle.

2 **Leader**: Jerk the chain and straighten its full length.

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TASK 3: **Fold the chain**

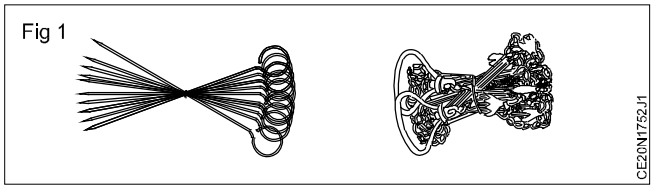
1 Leader to take the middle of the chain with his left hand, after completing the work.

2 Commence from middle, take two pairs of links at a time with right hand.

3 Place them in zig zag manner, arrange all pairs upto reach of the handle in the left.

4 Fasten the bundle of chain with leather strap tightly. (Fig 1)

Fig 1



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Ranging (direct/ indirect) and distance measure with chain/ tape

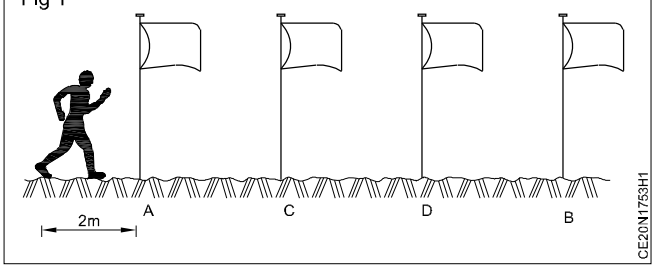
Objectives: At the end of this exercise you shall be able to
- **range a line in a plain ground and lay chaining in plain ground**
- **ranging indirect (or) reciprocal ranging, across valley and ranging on random line**
- **measure the distance between two given points within 30/20m**
- **measure the distance if it exceeds by one chain length.**

PROCEDURE

TASK 1: **Range a line AB in a plain ground**

1 Mark two stations A and B approximately 50m apart. (Fig 1)

Fig 1



2 Fix the ranging rods at stations A and B.

3 The surveyor stands about 2m behind the ranging rod at A on the line A, B.

4 Direct the assistant to hold a ranging rod vertically at arms length, at the point where the intermediate station 'C' is to be established.

5 Direct the assistant to move the rod to the right or left to the line AB until the three ranging rods appear to be exactly in a straight line.

6 Step down and check the position of the rod by sighting the lower end of the rod.

7 After ascertaining the three ranging rods are in a straight line, signal the assistant to fix the ranging rod at the position.

8 Repeat the same procedure for fixing other intermediate points.

— — — — — — — —

TASK 2: **Do chaining the line AB in a plain ground**

1 Keep one end of the chain at A and run the chain towards B passing through C.

2 Fix an arrow at the end of the chain

3 Drag the chain towards end B

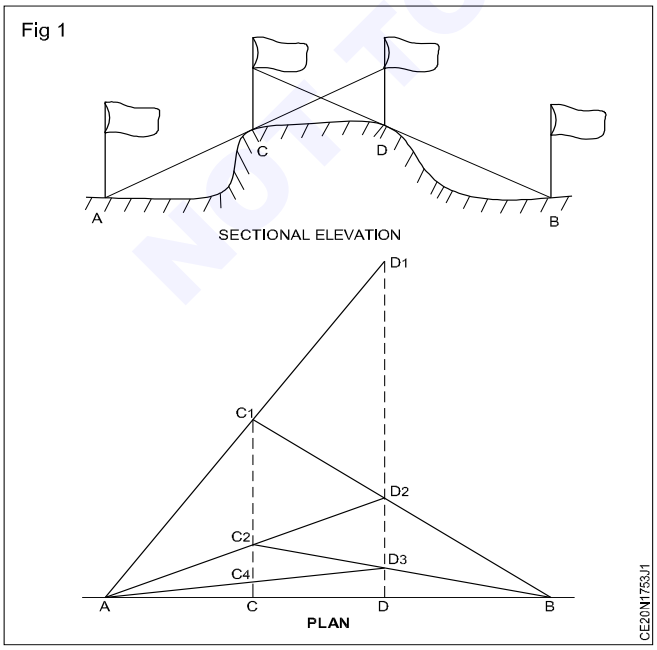
4 Read the remaining chain length

5 Total distance AB = No. of full chain + remaining chain length.

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TASK 3: **Indirect ranging or reciprocal ranging (Fig 1)**

Fig 1



1 Indirect ranging between two end points are not intervisible due to inter ranging high ground.

2 A and B are the two end stations

3 C and D are the two intermediate points to be fixed in line with A and B.

4 Select two positions of C and D on high ground and denoted as C_1 and D_1.

5 Surveyor at C_1 able to see D_1 and end ranging at B.

6 The surveyor at D_1 able to see C_1 and end ranging at 'A'.

7 Direct the assistant to move the position F. (Top of ranging rod at 'F' is in line of right points to the bottom of ranging rod at 'X'.)

8 Surveyor at C_1 direct the surveyor D_1 to move D_2 to be line with B.

9 The surveyor at D_2 directs C_1 to move to C_2 in line with A surveyor at C_2 directs D_2 to move D_3 in line with B.

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10 The same procedure to be adopted till no further movements of stations C and D.

11 Run the chain from A, C, D and D.

12 This is the desired positions of intermediate points in line with the end points i.e A as B.

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TASK 4: **Ranging across a valley (Fig 1)**

1 X, Y are the two station points at the ends of the valley.

2 The intermediate points A, B, E etc. are to be fixed in line with x and y across the valley.

3 Surveyor at 'X' directs the assistant at the station A to be in line with Y. (i.e) the top of ranging rod at A is brought in line with the bottom of the ranging rod at Y).

4 Surveyor at X again directs the assistant to move down wards to 'B' (i.e top of ranging rod at 'B' is in line of sight, pointing the bottom of ranging rod at 'A'.

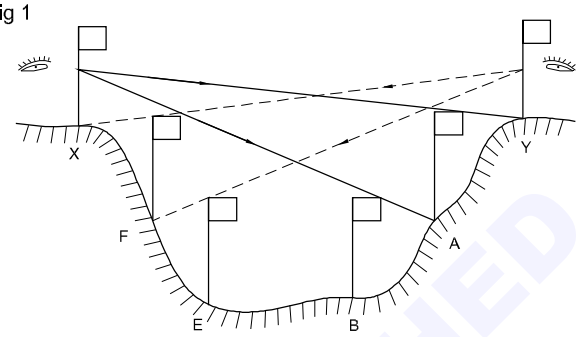
5 Continue this process unfill the point is reached near the lowest portion and which is invisible from X.

6 Surveyor goes to the other end 'Y'.

7 Continue the same process.

8 The station X, F, E, B, A and Y are in same straight line.

Fig 1



RANGING ACROSS A VALLEY

CE20N1753X1

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TASK 5: **Random line ranging**

1 Let A and B are the terminal station which are intervened by a jungle as shown in a Fig 1.

2 Form a random line AB1 from A.

3 Select B1 such that the line BB1 should be perpendicular to AB1.

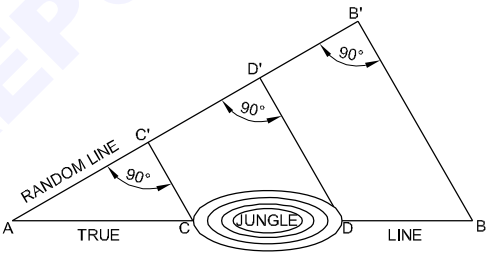
4 Measure the length of AB1 and BB1.

5 From that the distance AB can be calculated using the formula

$$AB = \sqrt{AB1^2 + BB1^2}$$

6 The distance CD can also be calculated using the same procedure as shown in the Fig 1.

Fig 1



CE20N1753Y1

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TASK 6: **Measure the distance between two given points within 30m/20m by using 30m/20m chain**

1 Select a point A on ground and fix an arrow at that point.

2 Unfold and stretch the 20m/30m chain from A to B in line with AB.

3 Count the tallies and links from A to B

4 This is the distance between A and B (Fig 1a)

Fig 1

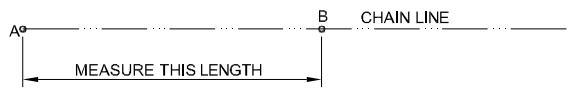
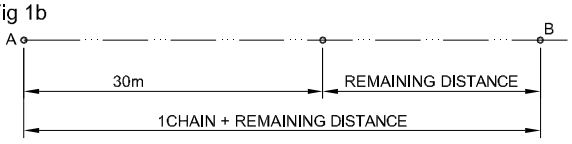


Fig 1b



CE20N1753Z1

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TASK 7: **Measure the distance if it exceeds by one chain length**

1 Fix an arrow at the end of the chain length.

2 Drag the chain forward to B.

3 Count as previously done.

4 Distance AB = No of full chain + Remaining distance measured (Fig 1b).

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Practice in offsetting and entering field book

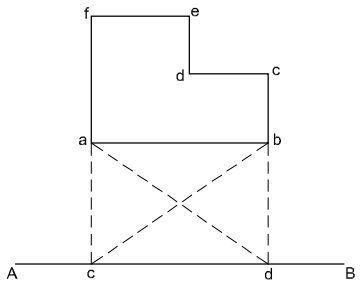
Objectives: At the end of this exercise you shall be able to
- **take perpendicular offsets to corners of an existing building**
- **take perpendicular offsets to a given Irregular fields**
- **take oblique offsets to an existing corner of a building.**

PROCEDURE

TASK 1: **Take perpendicular offsets to corners of an existing building**

1 By using cross staff (Fig 1)

Fig 1



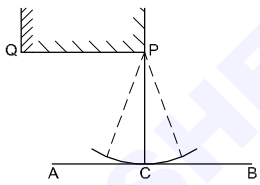
ca, db ARE THE PERPENDICULAR OFFSETS.
USING CROSS STAFF

CE20N1754H1

- Run a chain line AB approximately parallel to the side of building a, b on ground.
- Find the foot of the perpendicular offset C on the chain line AB at the first corner of the building 'a' by using cross staff.
- Repeat the same process to locate the foot of the perpendicular 'd' on the chain line AB to the second corner of the building 'b'.

2 By swinging arc method (Fig 2)

Fig 2



BY SWINGING ARC METHOD

CE20N1754H2

- Run a chain line AB approximately parallel to one side of the Building PQ.
- The leader hold the zero end of the tape at the point 'p'.
- The follower carries the tape box and swings the tape along the chain
- At the same time the follower finds the shortest distance from P at C on the line AB.

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TASK 2: **Take perpendicular offsets to a given Irregular fields (Fig 1)**

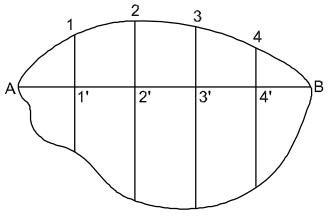
1 Run a chain line AB along the centre of the field.

2 Take offsets on both sides at suitable intervals and at such points where the direction suddenly changes.

3 Note the chainage and measure the offset.

4 Record the chainages at A,1',2',3' ..... etc and offset 11', 22', 33', ... etc in the field book.

Fig 1



OFFSETS FOR AN IRREGULAR BOUNDARY

CE20N1754J1

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TASK 3: **Take oblique offsets to an existing corner of a building (Fig 1)**

1 Run a chain line AB Approximately parallel to the existing building.

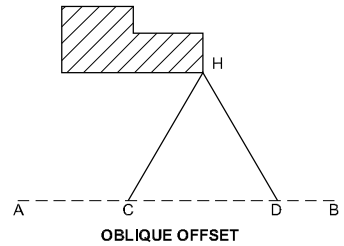
2 At a convenient full chainage say 2,3,4,5m..... etc select a point C and D on the chain line.

3 The points C, D and H should form approximately an equilateral triangle.

4 Measure oblique offsets CH and DH.

5 Record the chainages and offsets in the field book.

Fig 1



OBLIQUE OFFSET

CE20N1754X1

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Skill Sequence

Finding the foot of the perpendicular offset

Objective: This shall help you to
- **find the foot of the perpendicular offset on the chain line.**

1 Hold the ranging rod at corner of object ‘a’. (Fig 1)

2 Hold another ranging rod at B on the end of the chain line.

3 The leader moves the cross staff along the chain line AB by sighting Ranging rod at B through one groove.

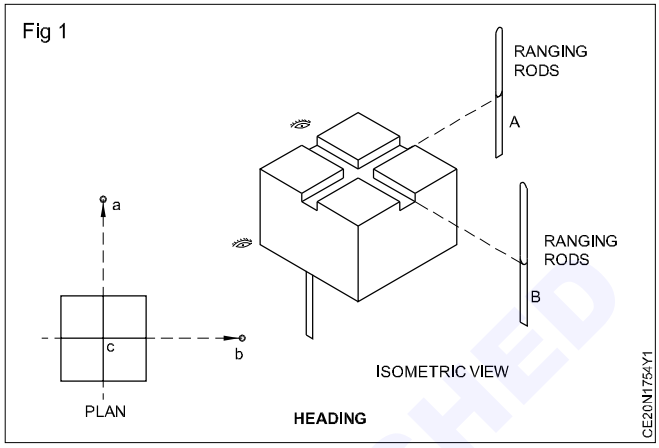
4 At the same time the follower sight the ranging rod at ‘a’ by the other groove.

5 Fix the cross staff at a point on the chain line AB where the two ranging rods are sighted through the grooves simultaneously. (Fig 1)

> **This is the point ‘C’ which is the foot of the perpendicular to the chain AB.**
>
> **Note the chainage and measure the offset.**

6 Record the chainage and offset in the field book

Fig 1



The above same procedure to be followed to locate the foot of the perpendicular ‘d’ to the object ‘b’.

Finding the foot of the perpendicular offset (Optical Square)

Objective: This shall help you to
- **find the foot of the perpendicular offset on the chain line by optical square.**

1 Fix one ranging rod at the object point ‘a’.

2 Fix another ranging rod at the end of the chain line ‘B’.

3 Hold the optical square and stand on the chain line ‘AB’.

4 Sight the ranging rod at ‘B’ through the smaller slot (eye hole) of the unsilvered mirror.

5 Move forward or backward on the chain line ‘AB’ until the image of the ranging rod at the object ‘a’ appeared in the silvered position of the mirror.

6 Move until the image of the ranging rod at ‘a’ coincides with the ranging rod at ‘B’, through the mirror.

7 Mark the position ‘C’ on the ground in the chain line ‘AB’.

8 Note the chainage and measure the offset.

9 Record the above chainage and offset in the field book.

Entering field book and plotting

Objectives: This shall help you to
- **entering single line field book**
- **entering double line field book**
- **survey and plot your ITI with chain.**

Entering single line and double line field book

1 Date of commencement and completion of survey and names of the survey.

2 Mark the symbols denoting the station point.

3 Note the details of survey lines.

4 Locate sketches of survey stations.

5 Mark the lines an AB & BC.

6 Start the booking from bottom of page and move upwards.

7 Record each chain line or tie line in a separate page.

8 The record should move in forward direction of chaining.

9 All measurements should be recorded immediately.

10 If the entire page is disregarded it should be crossed and marked as “CANCELLED”.

11 Indicate the offset objects with conventional signs (Fig 1 & 2).

12 Write the dimensions between the arrow heads.

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Fig 1

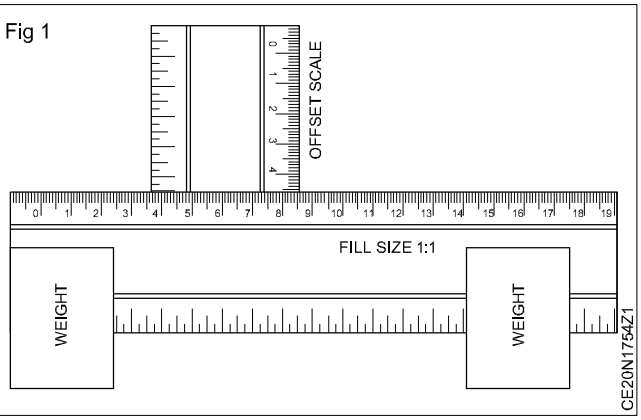
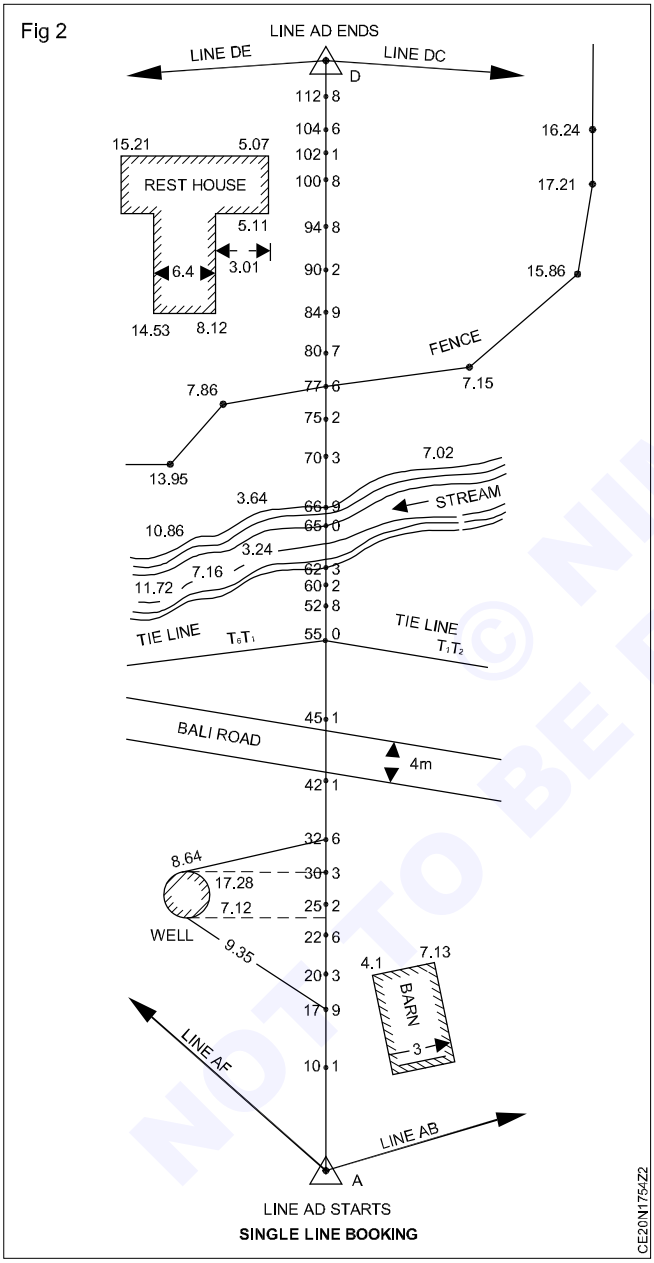


Fig 2



13 Write the offset close to the offset points. line with chainages.

14 For main station denote by the symbol Δ.

15 Write the zero change of the commencement inside the Δ.

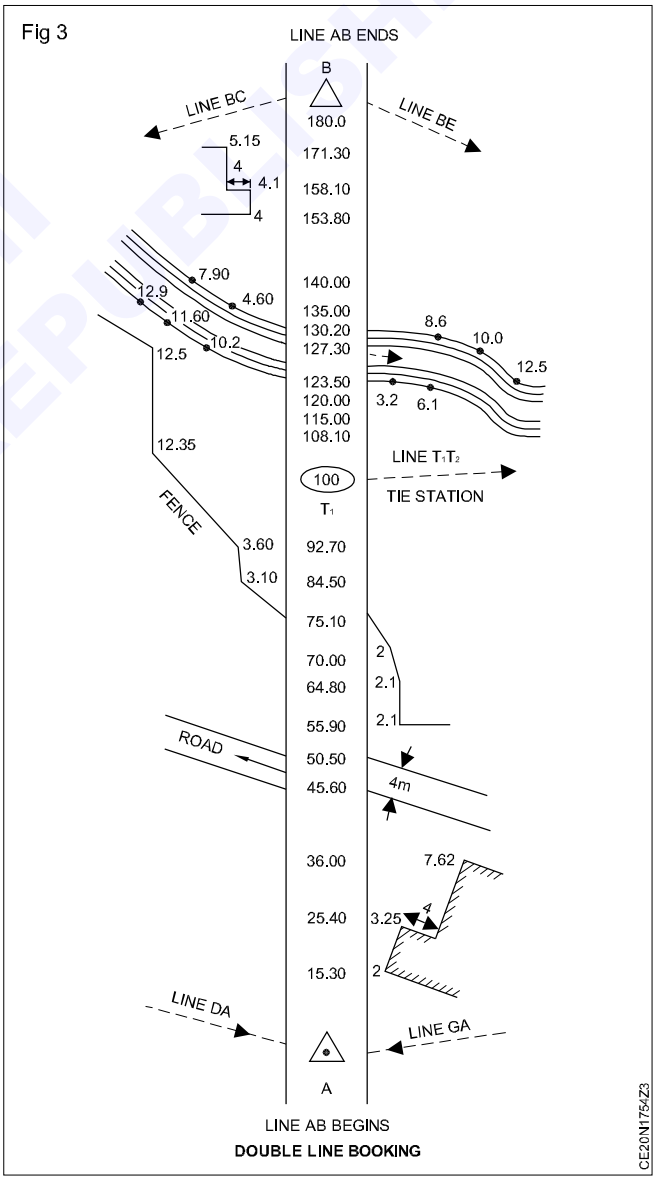
16 Close inside the Δ.

17 Mark the subsidiary stations by means of circle or as oval.

Plotting of a chain survey

- Plotting work is started after the field work is over.
- The survey is plotted on the drawing sheet with a suitable scale.
- It should be plotted always with north direction, so then the top of the drawing sheet represents north.
- The plotting should be always drown on the centre of the sheet taking sufficient spaces for margin, title and scale.

Fig 3



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- The base line is firstly drawn in its proper position.
- Intermediate stations are marked on the base line and complete the frame work of the triangles.
- The triangles are checked by check lines.
- For plotting offsets, mark the chainages of the points along the chain and from which the perpendicular offsets are marked by using an offset scale.
- The plotting of offsets should be continued according to the field book is maintained in the field book.
- The main stations and substations, objects, chain line are shown in accordance with the conventional signs.
- The heading should be written on the top of the drawing sheet.
- The map should not have any dimensions.

Offset scale (Fig 3)

- Using of offset scale for plotting perpendicular offset
- Put the long scale along the chain line, with its zero mark is exactly at the starting point of the line.
- The offset scale is placed at right angles to the long scale and moved to the required chainages. Then the offset lengths are marked with the help of the pricker.

North point

- The north point must be shown on a plan in any convenient blank space on the paper preferably at the top pointing upwards

Scale

- Scale should be drawn under the title or just inside the border at the bottom of the drawing.

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Practice chaining on sloping ground

Objective: At the end of this exercise you shall be able to
- **chaining on sloping ground.**

Requirements

Tools/Equipments/Instruments

- Metric chain 20m/30m - 1 Nos.
- Ranging rod 2/3m-3cm φ - 5 Nos.
- Measuring tape steel (30m) - 1 No.
- Plumb bob, spirit level (each) - 1 No .
- Arrows - 10 Nos.

Materials

- Field book - 1 No.
- Pencil - 1 No.
- Eraser - 1 No.

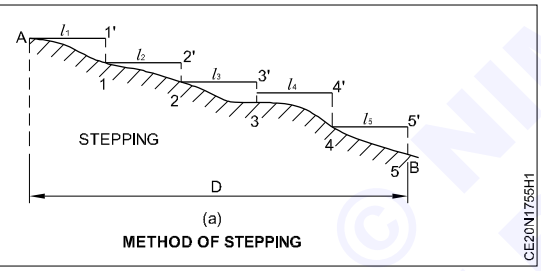
PROCEDURE

TASK 1: **Ranging and chaining on sloping ground**

1 Select a small hilly area to be surveyed.

2 Fix the station points A and B and erect ranging rods. (Both A & B are intervisible) (Fig 1)

Fig 1



(a)
METHOD OF STEPPING

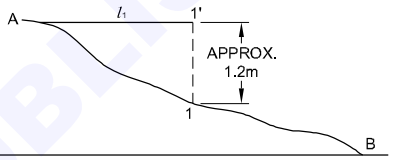
3 Hold the zero end of the steel tape at A on the ground by follower.

4 Hold the other end of the tape by the leader and move it to suitable length l_1 (not exceeding 6m) towards B and stretch it horizontally.

5 The follower directs the leader in line with B.

6 Leader holds the plumb bob at 1' and transfer it on the ground say 1 and record the distance l_1 (Fig 2).

Fig 2



(b)
THE VERTICAL DISTANCE 1'1, 2'2, 3'3....etc.,
SHOULD BE APPROXIMATELY 1.2m

7 The follower then moves to the point 1 and holding the zero ends of the tape.

8 The leader moves to the point 2' and stretches the tape horizontally.

9 The leader hold the plumb bob at 2' and transfer a point 2 on the ground and the record distance l_2.

10 Similarly moving towards B measure all the distances say l_3, l_4 and l_5.

11 The length of AB = $l_1 + l_2 + l_3 + l_4 + l_5$

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Practice on chain survey a small area with all details and plotting the map

Objective: At the end of this exercise you shall be able to
- **survey and plot your ITI with chain.**

PROCEDURE

TASK 1: **Survey and plot with chain**

Fig 1 shows the model site of the exercise.

Field work

1 Make reconnaissance survey prepare rough sketch of the given site in the field book.

2 Select and mark the control stations for the main line/ base line A to N covering the whole area to be surveyed.

3 Select the Base line AB and main lines BC, CD, DE, EF, FG, GH, FJ, JK & KL etc. (Fig 2)

4 Select the check line BC, BN,NT etc.

5 Select the tie stations T1,T2 etc as required for taking internal details.

6 Take reference sketches for the main stations.

7 Run the chain and measure the baseline AB, main lines check lines, and Tie lines and enter in the field book.

8 From the above measurements plot the frame work joining all points to a suitable scale and check the accuracy.

If the error is within maximum permissible value, then adjust the lengths of the sides of the wrong triangles, after that continue the survey.

If the error exceeds the permissible value then resurvey the wrong lines after that continue the same.

If there is no error, continuing the survey work measuring the chainages, and offsets on both sides of the chain lines and enter in the field book.

Office Work

9 Plot the details with conventional signs as per field book entries.

10 Print the title of the survey in right hand corner at the bottom or at the top of the drawing. Then note the scale of the drawing below it .

11 Mark the north direction on right top corner of the drawing sheet.

Use the conventional signs for the various types of objects

12 Draw all the boundary lines with Indian ink.

13 Give colouring according to the symbol.

Fig 1

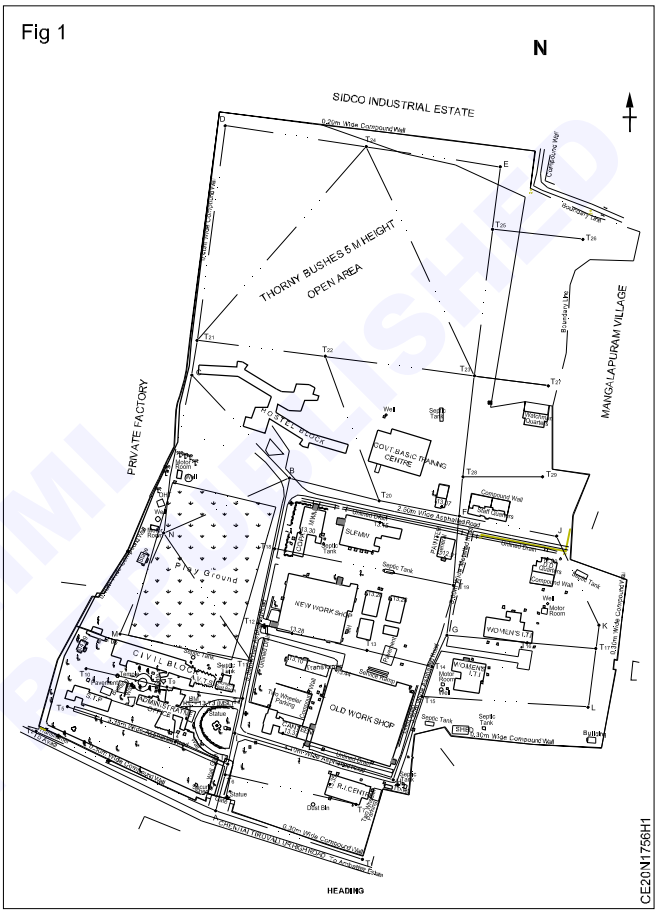
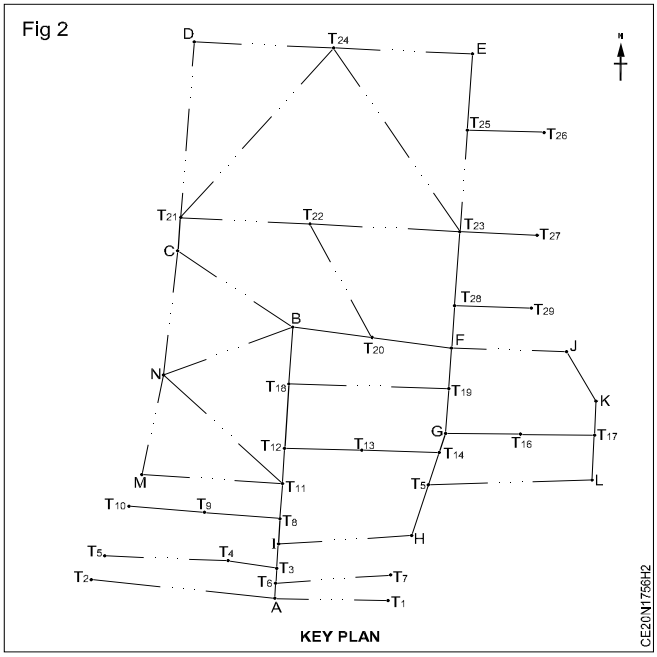


Fig 2



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Calculating the area of site

Objectives: At the end of this exercise you shall be able to
- **calculate the area of the polygonal shaped land.**

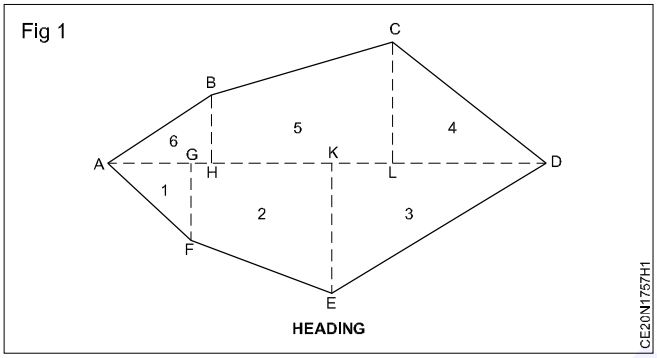
PROCEDURE

TASK 1: **Calculate the area of the polygonal shaped land**

Field work

1 Mark the given points ABCDE&F on the ground. (Given by the Instructor) (Fig 1)

Fig 1



2 Select the longest distance between any two points say AD as the base line.

3 Run the chain line along AD.

4 Locate the perpendicular offset FG.

5 Note the chainage at G and measure off set FG and enter in the field book.

6 Repeat the above process for locating the perpendicular offsets BH,EK and CL.

7 Note the chainages at H,K and L and measure offset BH, EK and CL and enter in the field book.

Office work

8 Draw the baseline AD to a suitable scale on the drawing sheet.

9 Mark the chainages G,H,K and L on AD.

10 Draw perpendicular offsets say FG,BH,EK and CL as per the field book.

11 Divide the polygonal shaped area into number of triangles and trapezium by joining the polygonal points A,B,C,D,E,F & A.

12 Calculate the area of the divided triangles and trapezium.

13 Calculate the total area by adding the area of above segments. (1 to 6)

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Prepare a site plan with the help of chain / tape

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

PROCEDURE

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

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

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

3 Create the outer line of building by providing given set backs.

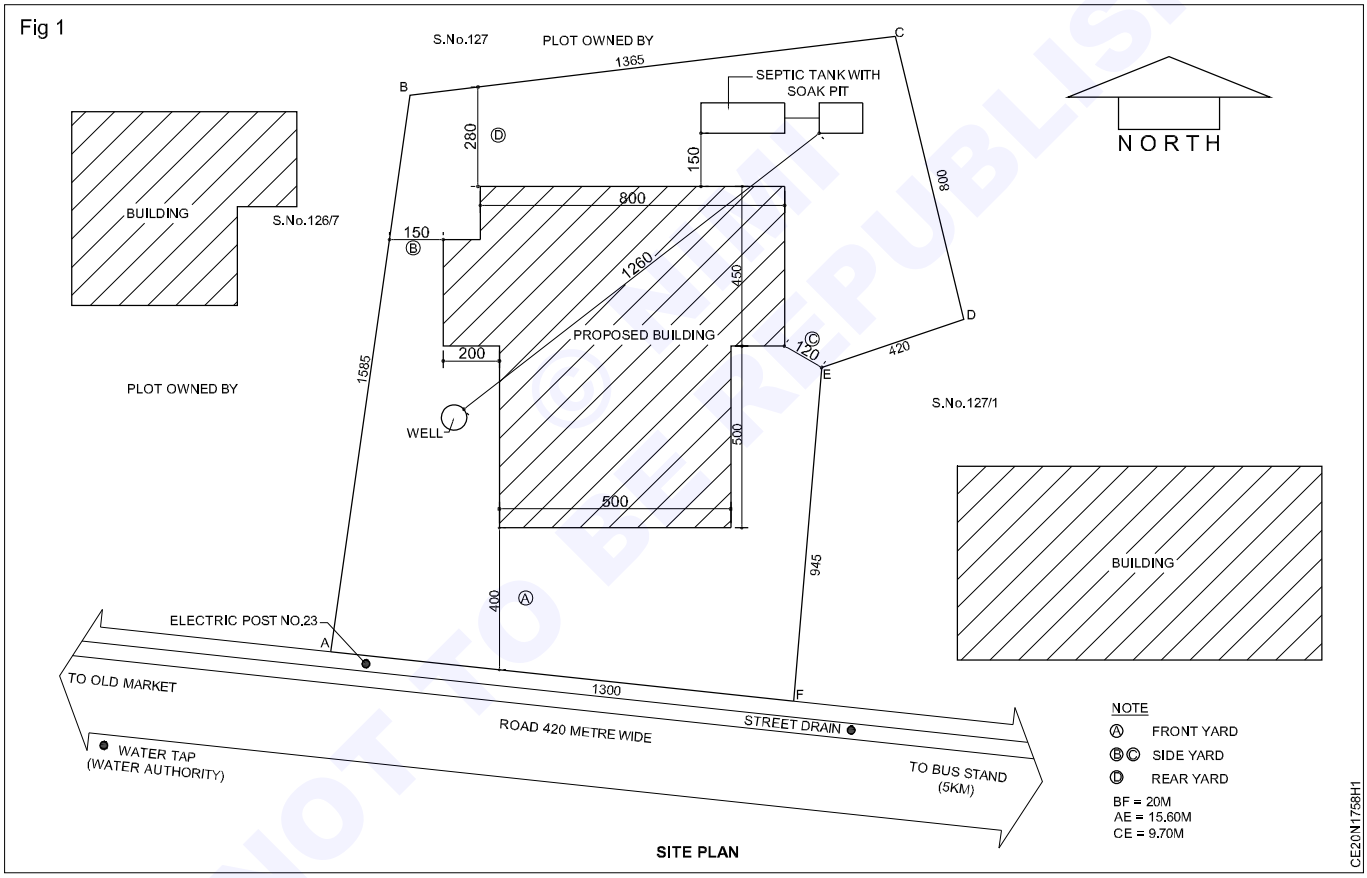
4 Create dimensions and other required notes as shown.

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

6 Draw symbols for north direction

7 Complete the required drawing.

Fig 1



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Temporary adjustment of prismatic compass

Objective: At the end of this exercise you shall be able to
- **center the compass exactly over the station, level the instrument and focusing the prism.**

PROCEDURE

TASK 1: **Centering of prismatic compass correctly over the station**

1 Drive an iron or wooden peg on the station.

2 Spread the tripod legs by loosening the leather strap

3 Place the tripod legs firmly on the ground approximately over the station.

4 Take out the compass from leather/plastic cover.

5 Remove the metal cover of the compass

6 Fix the compass on the top of the tripod.

7 Bring the object vane to vertical position as shown in Fig 1.

8 Bring the prism arrangement from position I to position II as shown in Fig 2.

9 Drop a small pebble from centre of the tripod

Fig 1

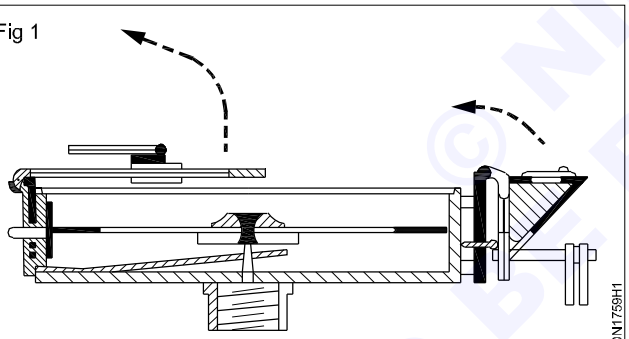


FIGURE SHOWING POSITION 1

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Fig 2

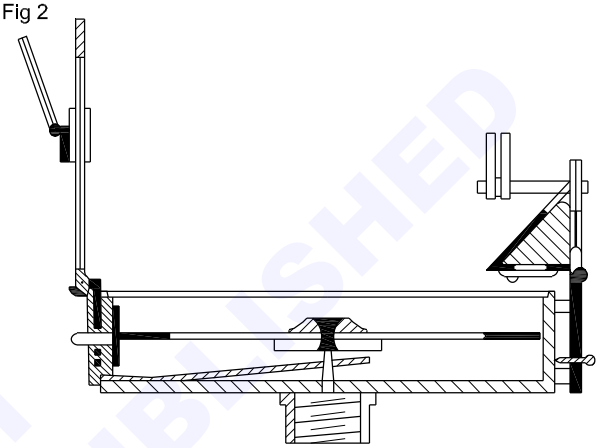


FIGURE SHOWING POSITION 2

CE20N1759H2

If the pebble falls on the centre of the peg, the compass is exactly centered over the station.

If the pebble does not fall on the peg, adjust the legs of the tripod

Again drop a small pebble from centre of the tripod.

10 Repeat the above procedure till the pebble falls exactly over the peg.

TASK 2: **Level the instrument**

1 Adjust the compass by using the ball and socket arrangement till the graduated ring swings freely after centering

2 Level it by eye judgement.

Check

- **Place a spirit level on glass cover of the compass**
- **If the bubble of the spirit level is at its centre, the compass is in levelled position.**
- **It the bubble is not at it's centre repeat the above procedure to being it at it's centre.**

TASK 3: **Focusing the prism**

1 Move the prism attachment slightly upward or downward till the readings can be seen sharp and clear after levelling.

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Determine the fore bearing and back bearing of a given line AB

Objectives: At the end of this exercise you shall be able to
- **observe the bearing and record the bearing**
- **check the accuracy of the instrument and plotting.**

PROCEDURE

TASK 1: **Observe the bearing (fore bearing and back bearing)**

1 Take bearing and check F.B. with B.B

2 Measure the horizontal distance of AB,BC, CD, DE and EF, and note in field book.

3 Setup the compass on station 'A' and level it .

4 Fix the ranging rods at station B to E where the bearings is to be located and observe the bearings.

5 Note down the bearings in the field book at each station BCD & E .

6 While proceeding survey talking check fore bearing with back bearing.

7 The F.B & B.B tallied / other wise there is local attraction.

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Measure true bearing of the line

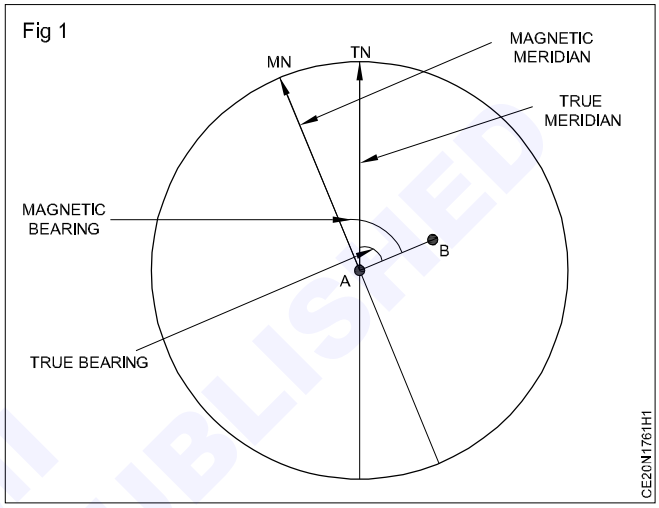
Objective: At the end of this exercise you shall be able to
- **measure the true bearing of the line.**

PROCEDURE

TASK 1: **Identification of true bearing**

Note: Refer the given figure. (Fig 1) use prismatic compass with tripod, ranging rod

Fig 1



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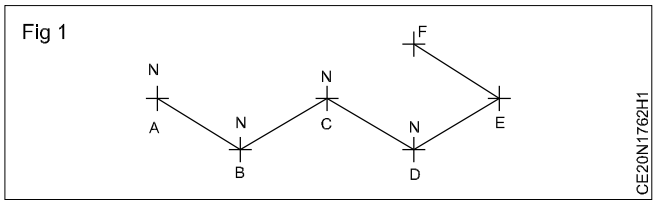
Prepare a closed and open traverse using primatic compass

Objectives: At the end of this exercise you shall be able to
- **observe the bearings of a given stations**
- **find the local attraction in any.**

PROCEDURE

TASK 1: **Select and drive the pegs ABCDE & F which are intervisible to each other**

Fig 1



TASK 2: **Observe the bearing (Fore bearing and Back bearing)**

1 Take bearing & check F.B with B.B

2 Measure the horizontal distance of AB,BC,CD,DE& EF. and note in field book

3 Setup the compass on station 'A' & Level it

4 Fix the ranging rods at station B to E where the bearings is to be located and observe the bearings

5 Note down the bearings in the field book at each station BCD&E

6 While proceeding the survey taking bearings check fore bearing with back bearing

7 The F.B & B.B are tallied/ other wise there is local attraction.

TASK 3: **Set out the rectilinear field as a per the given readings**

1 Before setting out the traverse in the field, calculate the interior angles for the station A, B, C and D and check it with the sum of included angles. $(2n \pm 4)90^0$.

2 Plot the traverse ABCDA with the given bearings and lengths.

3 Select a field without local attraction as far as possible for setting out a rectangular plot. (Fig 1)

4 Select a station 'A' in the field.

5 Set up the compass over the station 'A'.

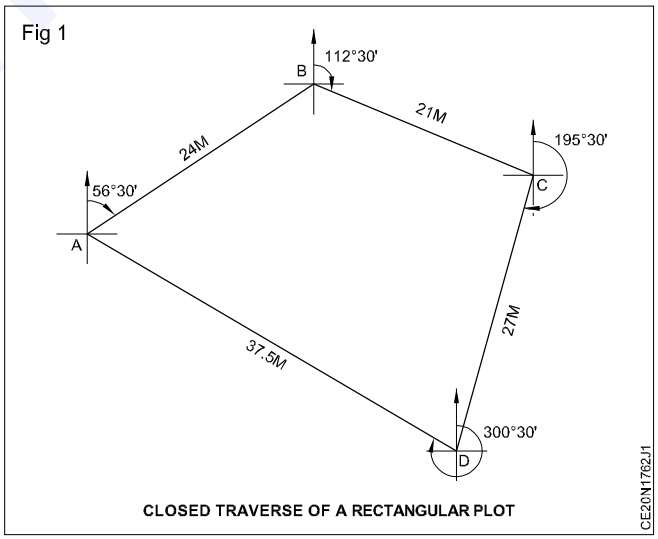
6 Set the given bearing of AB $56^0 30'$ in the compass.

7 Sight through eye vane and object vane and fix a ranging rod approximately equal to the given distance in the line of sight.

8 Mark the distance AB of 24m along the above line and fix a peg at 'B'.

9 Shift the compass and setup over the station 'B'.

Fig 1



CLOSED TRAVERSE OF A RECTANGULAR PLOT

10 Observe the back bearing of AB and check it with the given bearing of $236^0 30'$.

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If the observed back bearing of AB is not same as the given bearing the occurred error maybe,

Instrumental error (or)

Personal error (or)

Natural error

To rectify the above error, repeat the whole process from the beginning.

11 Set the given bearing of BC of $112^0 30'$ in the compass and sight through the line of sight.

12 Mark the given distance of BC of 21m and drive a peg at C.

13 Repeat the above procedure to complete the traverse ABCDA.

Line	Length in (m)	Fore bearing	Back bearing
AB	24.00	$56^0 30'$	$236^0 30'$
BC	21.00	$112^0 30'$	$292^0 30'$
CD	27.00	$195^0 30'$	$15^0 30'$
DA	37.50	$300^0 30'$	$120^0 30'$

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Demonstration of instrument used for plane table surveying and their uses (alidade, U fore, trough compass) Set up the plane table

Objectives: At the end of this exercise you shall be able to
- **demonstration of instrument used for plane table surveying centering, levelling, orientation.**

PROCEDURE

Instructor shall display and down trade to the students regarding the use of instrument used for plane table surveying (alidade, u- fore through compass) set up the plane table for centering, levelling and orientation

TASK 1: **Centering the plane table**

1 Clamp the board, after completing the levelling, centering should be done.

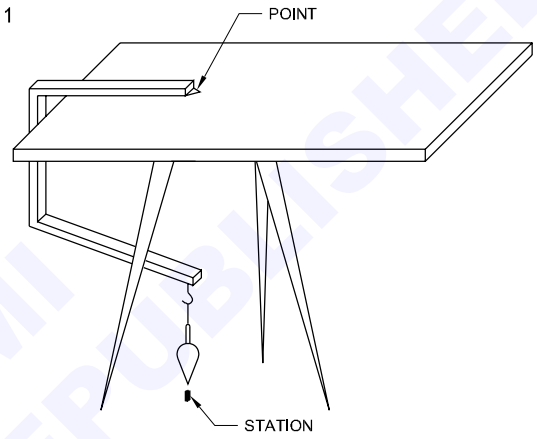
2 Select a point on the drawing sheet for the station occupied by the plane table by observing such that all the objects should be covered within the drawing sheet (Fig 1).

3 Fix a pin on the point.

4 Place the pointed end of the plumbing fork (or) 'U' frame touching the pin on the paper.

5 Shift the table bodily until the plumb - bob hangs exactly over the centre of the station peg.

Fig 1



CENTERING THE STATION

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TASK 2: **Level the plane table**

1 Spread the legs of the tripod in firm position approximately over the station.

2 Place the plane table over the tripod and tighten the clamp.

3 Adjust the legs of the tripod to bring the table to a convenient height of the surveyor.

4 Bring the longer edge of the table parallel to any two legs by rotating it about its vertical axis.

5 Place the spirit level on the table parallel to the longer edge of the table as in position 1 of Fig 1.

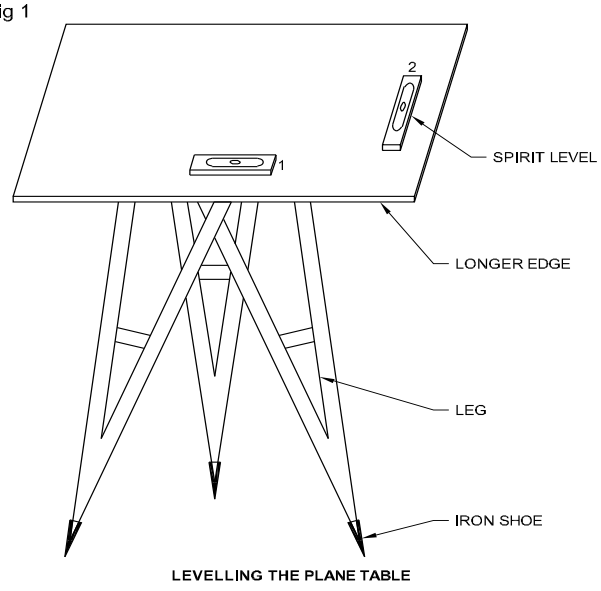
6 Bring the bubble of the spirit level to its centre by moving the third leg to its left or right.

7 Place the spirit level on the table perpendicular to its previous position as in position 2 of Fig 1.

8 Bring the bubble of the spirit level to its centre by moving the third leg to forward or backward.

9 Check the bubble of the spirit level remains central in all positions.

Fig 1



LEVELLING THE PLANE TABLE

10 Repeat the above process until the bubble of the spirit level remains central in all positions.

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TASK 3: **Orienting the plane table with a magnetic compass**

1 Select a station A and setup the table over the station and mark it as ‘a’ in the drawing sheet.

2 Place the trough compass on the right hand top corner of drawing sheet at the first station.

3 Draw a line along the longer edge of the Trough compass when the needle shows north direction exactly.

4 Select and fix a ranging rod at the next station ‘B’.

5 Keep the alidade touching the first station point on the drawing sheet.

6 Sight the next station through the alidade and draw a ray.

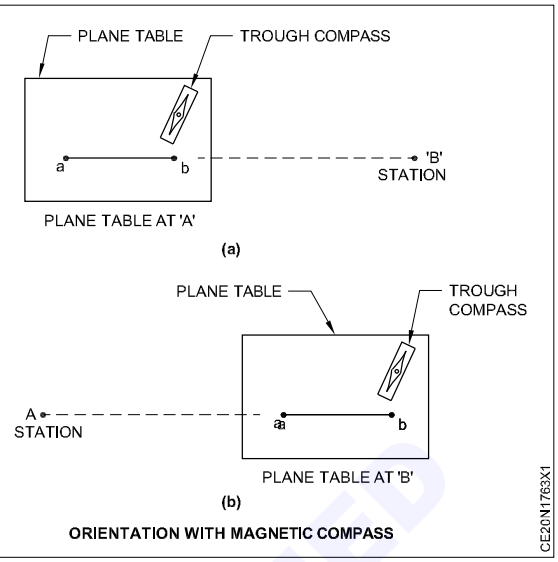
7 Measure the distance ‘AB’ on the ground and mark it on the sheet as ‘ab’ to a convenient scale. (Fig 1a).

8 Shift the plane table to the station ‘B’ after taking all the details from the first station.

9 Level and centre the plane table at the station ‘B’ with plumbing fork with plumb bob.

10 Place the compass along the north line already marked on the sheet.

Fig 1



11 Unclamp and turn the table until the needle show exactly in north direction. (Fig 1b)

12 Clamp the board in this oriented position of the table.

This method of orientation will not be accurate if any of the stations are affected by local attraction.

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TASK 4: **Orienting the plane table by back sighting**

1 Follow the first eight steps as in the previous skill (Orientating the plane table with a magnetic compass)

2 Level and centre the plane table at the station ‘B’, with plumbing fork with plumb bob. (Fig 1a)

3 Place the alidade along the ray ‘ba’ already drawn from the previous station to sight ‘A’.

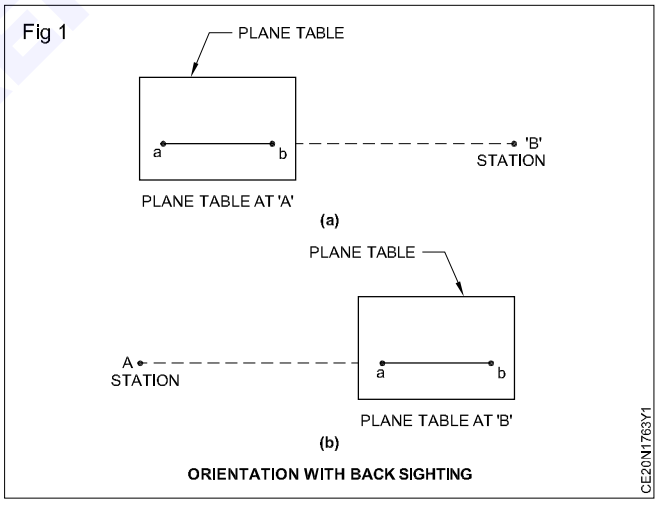
4 Rotate the table until the line of sight bisects the ranging rod at the previous station ‘A’.

This method of orientation will be accurate even all stations, are affected by Local attraction.

5 Now check the centering of the plane table over station ‘B’ with plotted position ‘b’ and correct it by bodily shifting the table.

6 Again keep the alidade along ‘ba’ and sight ‘A’ and rotate the table until it bisects ‘A’.

Fig 1



7 Repeat the above two process simultaneously until to get the exact orientation. (Fig 1b)

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Practice the method of plane tabling by radiation intersection, resection & traversing

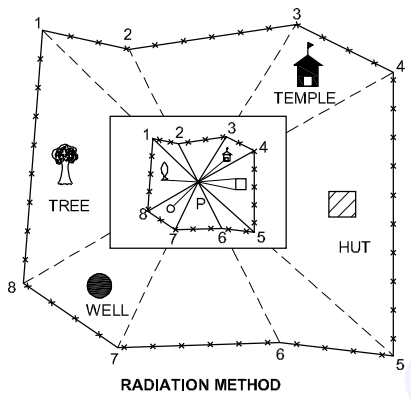
Objective: At the end of this exercise you shall be able to
- **locate and re-produce the ground boundary points on the sheet**
- **survey and locate boundaries and details of land by radiation method**
- **survey and locate the boundaries by intersection method**
- **survey, locate and check the boundaries by traversing method (closed traverse)**
- **Survey, locate and check the boundaries by the resection method of plane table survey.**

PROCEDURE

TASK 1: **Survey and locate the boundaries and details of land by radiation method**

1 Select 1,2,3,4,5,6,7 & 8 be the boundary points to be surveyed with some objects of an area as shown in Fig 1.

Fig 1



2 Let tree, temple, Hut & well be the some objects situated within the boundary as shown in Fig 1.

3 Select a station point ‘p’ which is visible from all the boundary points and the objects with in the boundary.

4 Set up the table over ‘p’ and mark ‘p’ on the drawing sheet and centre it.

5 Locate all the boundary points with suitable scale by the radiation method on the drawing sheet with alidade.

With the same instrument position locate the objects such as tree, temple, hut, well etc. with the use of alidade.

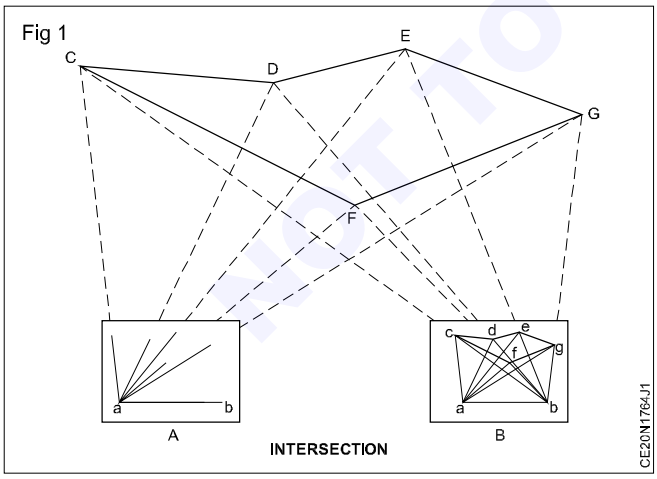
With the same scale mark and draw the conventional symbols for the different details.

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TASK 2: **Survey and locate the boundaries by intersection method**

1 Select 5 boundary points C,D,E,F & G on the ground and drive pegs. (Fig 1)

Fig 1



2 Select two base stations A, B on the ground so that all boundary points are visible from the stations.

3 Set up the table at A and level it.

4 Clamp the board after centering and levelling the plane table over station A.

5 Transfer the ground station ‘A’ as ‘a’ in the drawing sheet.

6 Keep the alidade touching ‘a’ sight ranging rod at the point c and draw a ray with pencil.

7 Similarly sight and draw the other rays from ‘a’ to other points D,E,F and G.

8 Sight the station B draw a ray and measure the distance scale it and mark as ‘b’

The line joining the base stations ‘A’ and ‘B’ known as base line should be visible to all points and be a round figure say 5 or 10m

9 Shift the plane table over station B and level, centre and orient it.

10 Keep the alidade touching ‘b’ sight the previous point ‘C’ and draw the ray to intersect corresponding ray at ‘c’.

11 Similarly sight and intersect all other points D,E,F and G to corresponding rays at d, e, f and g.

12 join the intersection of all these points c, d, e, f and g are the required boundary line.

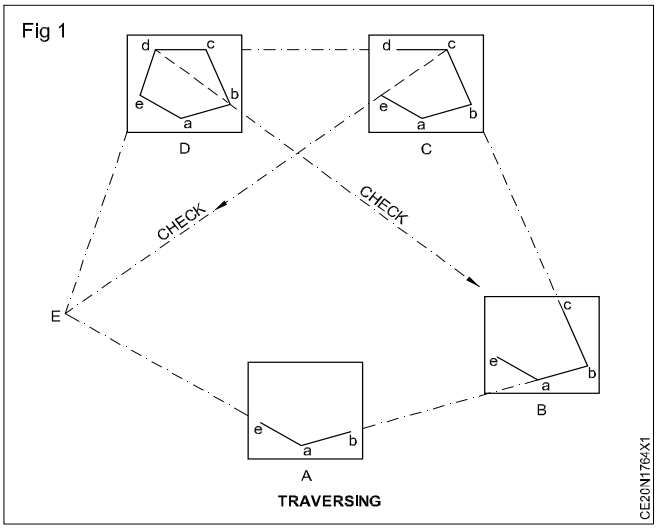
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TASK 3: **Survey, locate and check the boundaries by the traverse method (closed traverse)**

1 Select the running survey stations A,B,C,D,E to cover the whole area to be surveyed. (Fig 1)

Fig 1



2 Setup the table with drawing sheet over the station A level and centre it and mark as 'a'

3 With the help of a trough compass mark the magnetic north line on the right top corner of the drawing sheet.

4 Keep the alidade touching 'a' sight the station B and draw a ray and scale it with ground distance AB and mark as 'b'.

5 Similarly sight the station E and draw a ray measure 'AE' and mark as 'e'.

6 Shift the table to 'B' centre it level and orient it with station A.

7 Keep alidade touching 'b' sight the station C and draw a ray, scale it with ground distance BC and mark as c.

8 Similarly sight, measure and mark the other points up to D.

9 Also sight measure and mark the check lines CE and DB when the table is at 'C' and 'D'.

10 When the table is at D, sight the station E, measure and draw the ray 'de'.

This should be the exact point of ground station E, which is already drawn from A as back ray.

11 Check if 'de' coincides with point E, already plotted point 'e' there is no closing error.

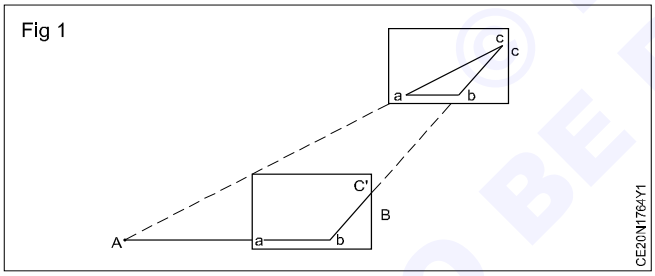
12 If not, join 'de' and find the closing error.

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TASK 4: **Survey, locate and check the boundaries by the resection method of plane table survey.**

1 It is used for locating the station points only. (Fig 1)

Fig 1



2 The main feature of resection is that the point plotted on the sheet is the station occupied by the plane table.

3 After stations are fixed the details are taken by radiation or intersection, or sometimes both.

4 Select a base line AB on the ground.

5 Measure the distance accurately and then plot 'ab' in a convenient position.

6 Set up and level the table at 'B' so that 'b' lies vertically above B and orient the table by placing the alidade along 'ab' and turning the table till 'A' is bisected and then clamp it.

7 With the alidade touching 'b' sight the station 'C' which is to be plotted by resection and draw a ray.

8 Estimate the distance BC by judgement only and move the point 'C' and along a ray to represent the approximate position of 'C'.

9 Shift the table and set it up with c, on the ground point 'C'.

10 Orient the table by taking back sight on 'B' and clamp it.

11 With the alidade pivoted on 'a' sight the station 'A' and draw a ray.

12 The point of intersection of this ray and that previously drawn from 'b' gives the required point 'c'. (i.e.) true position of 'c'.

13 If necessary locate the other station in the above manner. It is also known as back ray method.

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Determination of height by telescopic alidade

Objective: At the end of this exercise you shall be able to
- **find the height of building using telescopic alidade.**

Requirements

Tools / Instruments

- Plane table with Tripod - 1 No.
- Alidade - 1 No.
- Spirit level - 1 No.
- Trough compass - 1 No.
- Plumbing fork with plumb bob - 1 No.
- Measuring tape 30m - 1 No.
- Arrows - 10 Nos.
- Peg 15cm long - 6 Nos.
- Ranging Rod 2/3m long - 2 Nos.

Materials

- Set of scale - 1 Set.
- Pencil, HB - 1 No.
- Eraser - 1 No.
- Drawing sheet A3 - 1 No.
- Cello tape - 1 No.

PROCEDURE

TASK 1: **Determine the height of building by telescopic alidade**

1 Select a point ‘p’ at a convenient distance from the building

2 Set up and level the plane table by

3 Levelling the plane table

4 Centering the plane table

5 Orientating the plane table

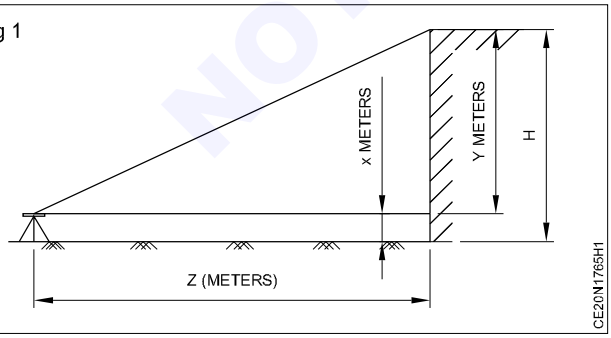
6 Fix the drawing sheet carefully on plane table without any dislocation of plane of table.

7 Transfer the ground point ‘p’ to the sheet by using ‘U’ fork and plumb bob.

8 Place the Telescopic alidade on the table & level the telescope to the horizontal, gently use the telescope and tight or loose the nut.

9 From the station point ‘p’ to the foot of the building range through telescope alidade and take the reading and find the R.L of the point (Fig 1)

Fig 1



10 Measure the distance form point ‘p’ to the foot of the building

11 Where the R.L. reading taken

12 Note down the distance in metre

13 Then slowly tilt the telescope of alidade by loosening the telescope nut to the apex point of the building.

14 Note down the angle of telescope elevation.

15 Then calculate the height of building as follows.

Where,

Z = Horizontal distance form building to plane table.

X = Height of plane table

Y = Height of building from plane table level.

H = Total height of building

ø = Angle of elevation from plane table station

(x+y) = Height of the building (H)

Y = Z (tan ø)

X+Y = (Height of building)

H = x+z tan ø

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Handling and practice of levelling instruments and their settings

Objectives: At the end of this exercise you shall be able to
- **identify type of level**
- **identify the parts of dumpy level and auto level**
- **identify the construction of telescopic leveling staff**
- **level the plane table and reading the leveling staff.**

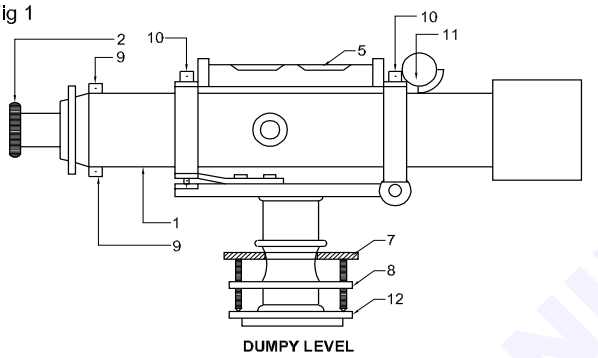
PROCEDURE

TASK 1: **Identifying the parts of levels**

1 Remove the dumpy level from the wooden box.

Note: The position of object glass and eye piece before the removal. (Fig 1)

Fig 1



DUMPY LEVEL

2 Spread the legs of the tripod at a convenient height.

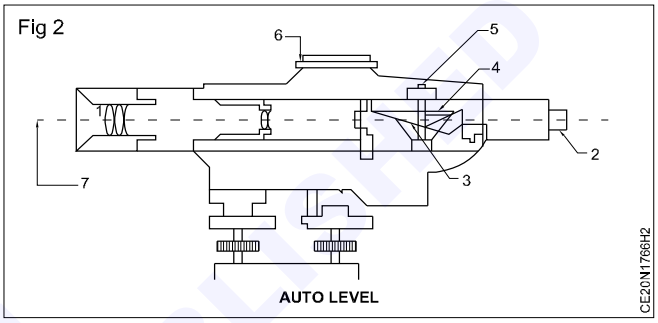
3 Fix the level over the tripod and explain its parts.

1 Telescope, 2. Eye - piece, 3. Ray shade, 4. Objective end, 5, Longitudinal bubble, 6. Focusing screws, 7. Foot screws, 8. Upper parallel plate (Tribrach), 9. Diaphragm adjusting screws, 10. Bubble tube adjusting screws, 11. Transverse bubble tube, 12. Foot plate (Trivet stage)

2 Similarly explain the parts of auto level. (Fig 2)

1 Objective lens, 2 Eyepiece, 3 Compensator object, 4 Compensator suspension, 5. Magnetic dampering system, 6 Line of sight

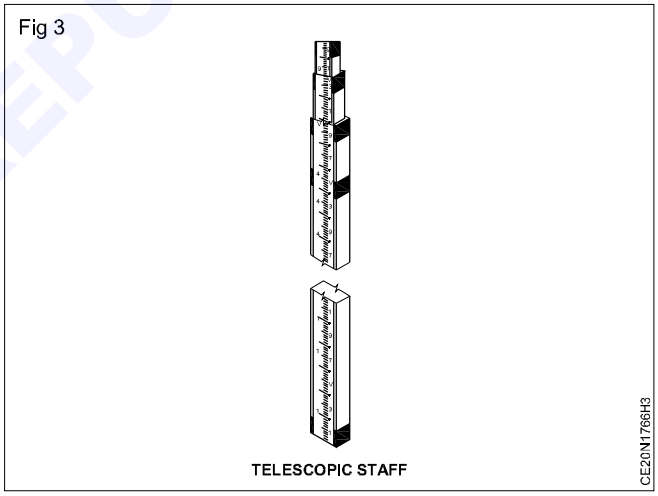
Fig 2



AUTO LEVEL

5 Explain the construction of telescopic leveling staff. (Fig 3)

Fig 3



TELESCOPIC STAFF

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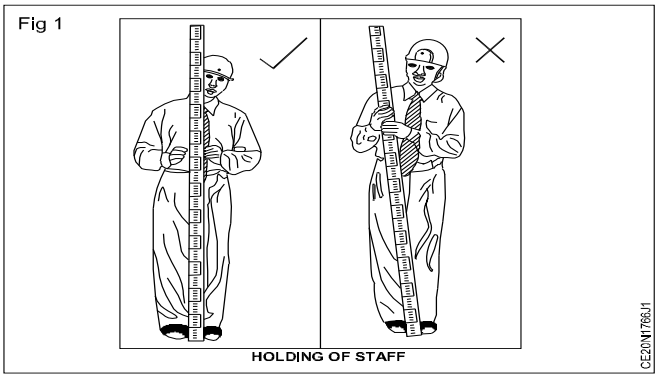
TASK 2: **Holding of staff**

1 Stretch the staff to its full length.

2 Place the bottom of the staff between the toes.

3 Hold the staff between the palms of the hands at the height of the face. (Fig 1)

Fig 1



HOLDING OF STAFF

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TASK 3: **Reading the leveling staff**

1 Set up and level the dumpy level at a suitable position.

2 Hold the staff vertically at staff station.

3 Direct the telescope towards the leveling staff and focus the telescope.

4 Check the verticality of the staff with the vertical hair and adjust it with the use of hand signals.

Signal (Fig 1)	Message
Movement of the left arm over 90°.	Move to my left. (Fig 1a)
Movement of the right arm over 90°.	Move to my right. (Fig 1b)
Movement of the left arm over 30°.	Move top of staff to my left. (Fig 1c)
Movement of the right arm over 30°.	Move top of staff to my right. (Fig 1d)
Extension of arm horizontally and moving hand upwards.	Raise height of peg or staff. (Fig 1e)
Extension of arm horizontally and moving hand downwards.	Lower height of peg or staff. (Fig 1f)
Extension of both arms and slightly thrusting downwards.	Establish the position. (Fig 1g)
Extension of arms and placement of hand on top of head.	Return to me. (Fig 1h)

5 Check the position of the bubble. If it is not at the centre, bring it to the centre of its run using the foot screw beneath or nearer to telescope.

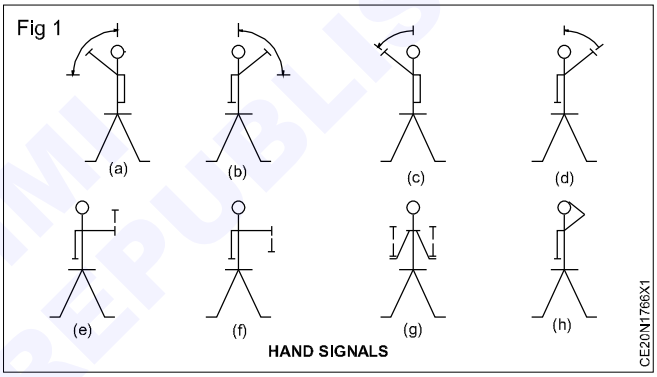
6 Note the reading against the horizontal hair appears to cut the staff.

7 First note the red figure denoting the metre numeral on the left of the staff.

8 Secondly note the black figure denoting the minimum decimeter reading.

9 Finally count the number of black and white strips graduated to read the centimeters and millimeters, where the horizontal cross haircuts the staff.

Fig 1



The graduations are marked erect in the staff, and therefore, while looking through the telescope the staff is seen as inverted. Hence the staff should be read from top to bottom.

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Temporary adjustments of level

Objectives: At the end of this exercise you shall be able to
- **set up the tripod on the ground**
- **fix the instrument on the tripod**
- **level the instrument**
- **perform elimination of parallax.**

PROCEDURE

TASK 1: **Setting up the tripod on the ground (Fig 1)**

1 Loosen the strap of the tripod.

2 Spread the legs of the tripod to a convenient height.

3 Keep the two legs firmly on one side of a non-slippery ground and the third on the other side.

4 Adjust the third leg so that the top of the tripod is approximately horizontal by eye judgement.

Fig 1



TASK 2: **Fix the instrument on the tripod**

1 After noting the position of the level in the box, remove it from the box.

2 Release the clamp screw of the instrument and hold it with right hand.

3 Turn round the lower part of the level with the left hand and screw the instrument firmly on the tripod.

TASK 3: **Levelling of the instrument (Fig 1)**

1 Place the telescope parallel to the line joining the two foot screws.

2 Bring the bubble of the spirit level on the telescope to the centre of its run by turning the foot screws beneath the telescope either inward or outward.

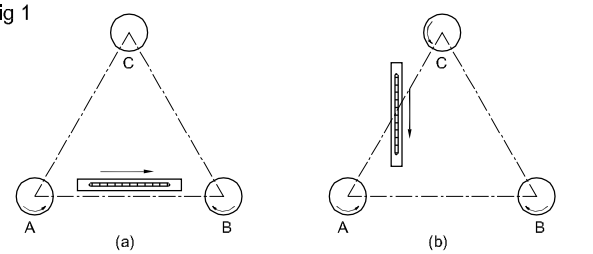
3 Turn the telescope through 90° to its previous position.

4 Turn the third foot screw inward or outward and bring the bubble of the spirit level on the telescope to the centre of its run.

5 Repeat the step 2 and step 4 several times so that the bubble remains in the centre in all positions of the telescope.

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Fig 1



LEVELLING UP WITH THREE FOOTSCREWS

TASK 4: **Elimination of parallax (Fig 1)**

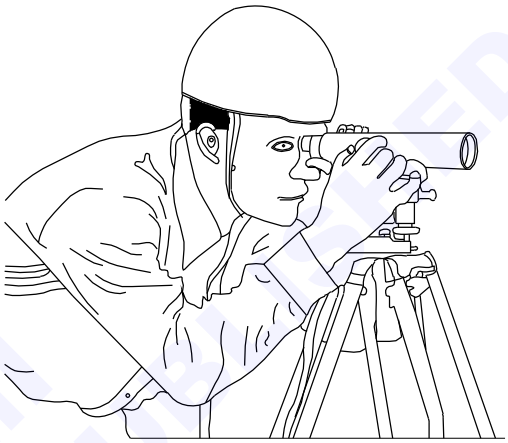
1 Focusing of the eye-piece.

- Remove the lid of the telescope.
- Direct the telescope towards the sky or towards a white paper.
- Looking through the telescope, turn the eye-piece inward or outward till clear image of cross wires is obtained.

2 Focusing of the object glass.

- Direct the telescope towards the leveling staff.
- Turn the focusing screw inward or outward till clear image of the leveling staff is seen.
- Check for the parallax by moving the eye up or down.

Fig 1



FOCUSSING THE OBJECT

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Simple levelling

Objectives: At the end of this exercise you shall be able to
- **measure the level difference between the points A and B and determine the reduced level of one point with reference to the other.**

Requirements

Tools/Equipments/Instruments

- Dumpy level with tripod - 1 No.
- Levelling staff - 1 No.

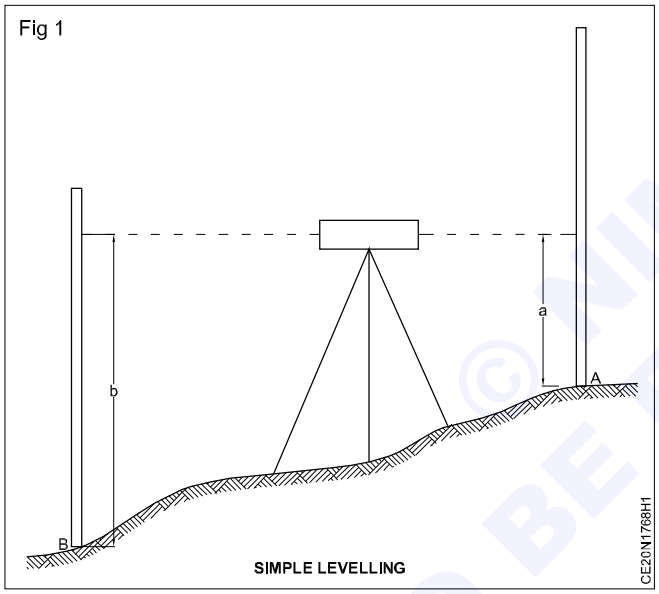
Materials

- Levelling field book - 1 No.

PROCEDURE

TASK 1: **Measure the level difference between the points A and B and determine the reduced level of one point with reference to the other (Fig 1)**

Fig 1



1 Select two station points A and B on a firm ground.

2 Set up and level the instrument approximately at midpoint O.

3 Take staff readings on A and B, let the readings be a and b respectively.

4 The level difference between A and B is equal to the difference of the staff readings observed at station A and station B.

ie: level difference = b - a (if b > a).

5 If the reduced level of A is known, the reduced level of B = reduced level of A - level difference.

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Differential levelling (fly levelling)

Objective: At the end of this exercise you shall be able to
- **determine the level difference between two points A and B, when it is not possible to see both stations from a single set up.**

Requirements

Tools/Equipments/Instruments

- Dumpy level with tripod - 1 No each.
- Telescopic leveling staff - 1 No.
- Peg, hammer - 1 No each.

Materials

- Level field book - 1 No.
- Pencil - 1 No.
- Eraser - 1 No.

PROCEDURE

TASK 1: **Differential levelling**

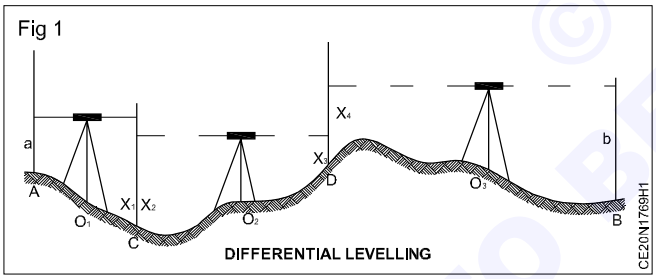
1 Let A and B be the two points whose level difference is to be determined, which are far away from each other.

a Set up and level the instrument at O_1. (Fig 1)

b Take staff readings on stations A and C. Enter the readings on field book as 'a' and 'X_1' respectively.

c Shift and place the instrument on O_2. Carry out temporary adjustments. Then take staff readings on C and D. Note it on the field book as X_2 and X_3.

Fig 1



d Repeat the process until a foresight reading (b) is taken on station B.

BS	IS	FS	HI	RL	Remarks
a					Station A
X_2		X_1			Station C
X_4		X_3			Station D
		b			Station B

e Level difference between A and B = $\sum$ BS- $\sum$ FS = $(a+X_2+X_4) - (X_1+X_3+b)$

f Reduced level of B = reduced level of A ± [$(a+X_2+X_4) - (X_1+X_3+b)$]

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Carryout levelling in field book

Objective: At the end of this exercise you shall be able to
- **enter the field book by height of collimation method and rise and fall method.**

Requirements

Tools/Equipments/Instruments

- Dumpy level with tripod - 1 No each.
- Telescopic leveling staff - 1 No.
- Peg, hammer - 1 No each.

Materials

- Level field book - 1 No.
- Pencil - 1 No.
- Eraser - 1 No.

PROCEDURE

TASK 1: **Holding of staff**

Refer Ex. No: 1 - 8 - 66 Task 2

TASK 2: **Reading the levelling staff**

Refer Ex. No: 1-8-66 Task 3

TASK 3: **Enter the field book by Height of collimation method and Rise and fall method**

1 The observations X_1, X_2, X_3 X_4, and X_5 are taken from a single set up of level.

2 The readings for the both method may be recorded as given below.

3 Each row represents station points.

4 For the both method the first staff reading is taken to a point of known elevation.

5 This is known as back sight. (X_1)

6 Enter this in the BS column of the both method in the first row.

7 The last staff reading of the both is taken on a point of unknown elevation. (X_5)

8 Enter this is the FS column of both method.

9 The sights in between BS & FS is intermediate sights. (X_2,X_3,X_4)

10 The above are entered in the is column of both methods.

Table 1 - Height of collimation method

BS	IS	FS	HI	RL	Remarks
X_1			HI = R_1+X_1	R1	BM
	X_2			HI_1-X_2	Station A
	X_3			HI_1-X_3	Station B
	X_4			HI_1-X_4	Station C
		X_5		HI_1-X_5	Station D

Check : BS - FS = Last RL - First RL.

Table 2 - Rise and Fall Method

BS1	IS	FS	Rise	Fall	RL	Remarks
X_1					R_1	BM
	X_2					Station A
	X_3					Station B
	X_4					Station C
		X_5				Station D

Check: (BS - FS) = (RISE - FAIL) = (Last RL - First RL)

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Equate reduction of level (Rise and fall method and height of collimation method) comparison of method

Objectives: At the end of this exercise you shall be able to
- **select an instrument position for the successive setup of instrument for finding reduced levels**
- **determine the RLs of all the given points.**

PROCEDURE

TASK 1: **Equating reduction of level**

1 Select and setup the instrument at position O1. (Fig 1)

2 Direct the telescope towards levelling staff held vertically on BM (A) and focus it carefully and take the reading (say 0.535) and enter back sight in a field book.

3 Send the staff man to the station B, C and D and take inter sight readings 2.145, 2.435, 1.585 and enter in the field book.

4 Send the staff man to the station E, (as a change point 1) direct the telescope and take the readings 0.630 and enter fore sight in the field book.

5 Select, shift and setup the instrument position at O2.

6 With the bubble central, take the back sight reading on the staff, held vertically at E again 1.535 and enter in the field book.

7 Similarly direct the telescope towards the station F take readings 2.015 enter inter sight in the field book.

8 Send the staff man to the station G (as a charge point 2) direct the telescope and take readings 3.510 and enter fore sight in a field book.

9 Select shift and setup the instrument at position O3 take staff readings 3.340 at station G enter back sight in the field book.

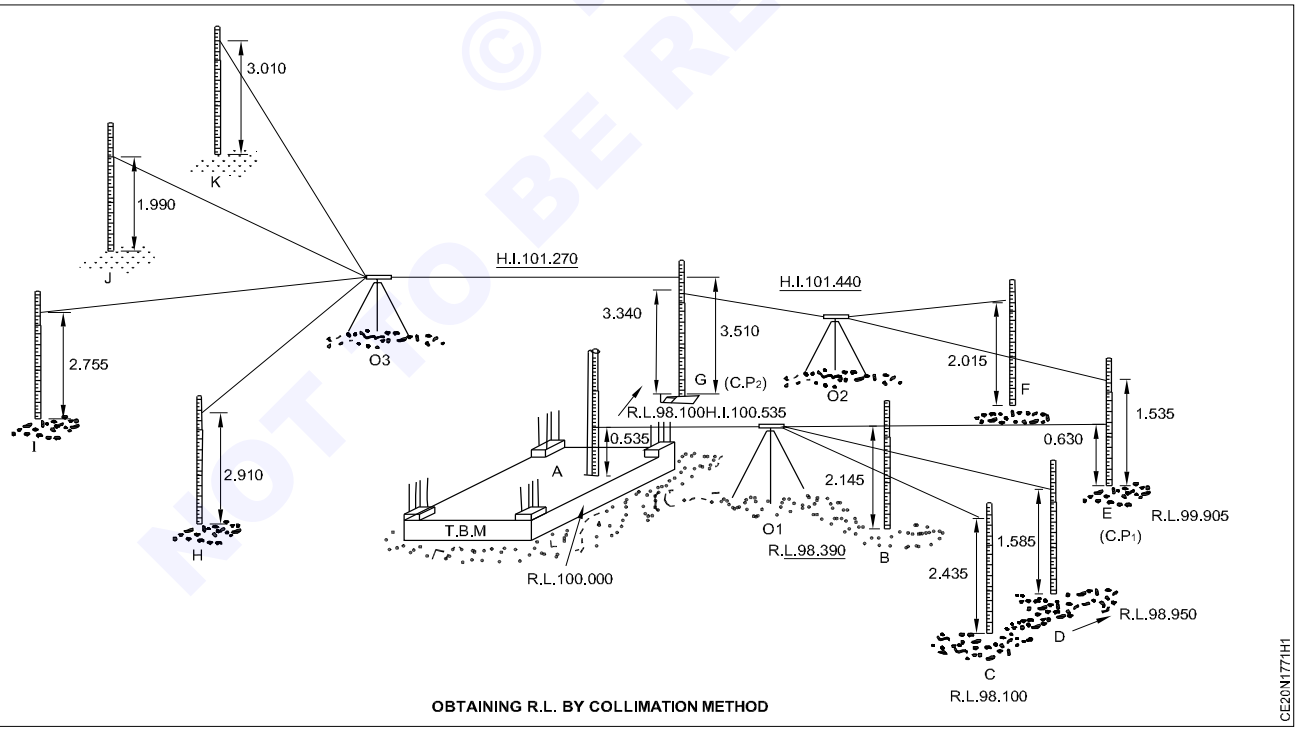
10 Similarly take staff man readings at station H, I and J enter the intersight readings 2.910, 2.755, 1.990 in the field book.

11 Send the levelling staff man at last station 'k' take fore sight reading 3.010 enter in the field book.

12 Reduce the levels by any one method.

13 Apply arithmetical check.

Fig 1



OBTAINING R.L. BY COLLIMATION METHOD

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Height of collimation method

Back sight	Inter sight	Fore sight	HC	Reduced Levels	Remarks
0.535			100.535	100.000	Reading at B.M at A
	2.145			98.390	Reading at station B
	2.435			98.100	-do- at C
	1.585			98.950	-do - at D
1.535		0.630	101.440	99.905	-do- at E
	2.015			99.425	-do-at F
3.340		3.510	101.270	97.930	-do- at G
	2.910			98.360	-do- at H
	2.755			98.515	-do- at I
	1.990			99.280	-do- at J
		3.010		98.260	-do- at K
5.410		7.150			

Arithmetical check: $\sum$ B.S - $\sum$ F.S = Last R.L - First R.L

5.410 - 7.150 = 98.260 - 100.00 (-) 1.740 = (-) 1.740

Rise and Fall Method

Station	Reading			Rise	Fall	RL	Remarks
	BS	IS	FS				
01	0.535					100.000	Reading at BM at A
		2.145			1.610	98.390	Reading at station B
		2.435			0.290	98.100	- do - at C
		1.585		0.850		98.950	- do - at D
02	1.535		0.630	0.955		99.905	- do - at E
		2.015			0.480	99.425	- do - at F
03	3.340		3.510		1.495	97.930	- do - at G
		2.910		0.430		98.360	- do - at H
		2.755		0.155		98.515	- do - at I
		1.990		0.765		99.280	- do - at J
			3.010		1.020	98.260	- do - at k
Total	5.410		7.150	3.155	4.895		

Arithmetical check

$\sum$ B.S - $\sum$ F.S = $\sum$ Rise - $\sum$ Fall = Last R.L - First R.L - 1.740 = - 1.740 = - 1.740

5.410 - 7.150 = 3.155 - 4.895 = 98.260 - 100.000

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Solve problems on reduction of levels

Objectives: At the end of this exercise you shall be able to
- **determine the reduced levels of the station points by height of collimation method**
- **determine the reduced levels of the station points by rise and fall method.**

PROCEDURE

TASK 1: **Problem in levelling**

1 Following consecutive readings were taken on points 1 to 7 along a line.

2 0785, 1.326, 2.538, 3.435, 1.367, 2.328, 1.234, 1.657

3 The instrument was shifted after the fourth reading and the first reading was taken on BM with RL = 100.00. rule out a page of level book and work out the RL of all points by **Height of Collimation Method and Rise and Fall Method**.

Solution

Station	Readings			Height of line of collimation	RL	Remark
	B.S.	I.S.	F.S			
1	0.785			100.785	100.00	BM
2		1.326			99.459	RL = 100
3		2.538			98.247	
4	1.367		3.435	98.717	97.350	
5		1.238			96.389	
6		1.234			97.483	
7			1.657	97.060		
Total	2.152		5.092			

H.I. = R.L. + B.S. = 100.00 + 0.785 = 100.785

R.L. = H.I. – I.S / F.S. = 100.785 – 1.367 = 99.459

Arithmetical check

Σ B.S. – Σ F.S. = 02.152 – 5.092 = -2.940

Last R.L. – First R.L. = 97.060 – 100.00 = 2.940 Ans.

— — — — — — — —

TASK 2: **Problem in levelling using rise and fall method**

1 The readings are entered in the page of level field book as shown below. Reduce the levels by both the **Height of collimation method and Rise and Fall method**, given the R.L. of a B.M. 1 as 200.000 m. Apply the check.

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Solution for the above problem in rise and fall method

Station	Readings			Rise	Fall	RL	Remark
	B.S.	I.S.	F.S				
1	0.785					100.00	BM
2		1.326			0.541	99.459	RL = 100
3		2.538			1.212	98.247	
4	1.367		3.435		0.897	97.350	CP
5		2.328			0.961	96.389	
6		1.234		1.094		97.483	
7			1.657		0.423	97.060	
Σ B	2.152	Σ F.S	5.092	1.094	4.034		

Arithmetical checks

Σ B.S. – Σ F.S. = 2.152 – 5.092 = -2.940

Σ Rise – Σ Fall = 1.094 – 4.034 = -2.940

Last R.L. – First R.L. = 97.060 – 100.00 = 2.940 Ans.

— — — — — — — —

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Calculate missing data and filling calculations and arithmetical check in levelling survey

Objectives: At the end of this exercise you shall be able to
- **calculate the entries marked (x) from the level book**
- **complete arithmetic check**
- **solve various problems.**

PROCEDURE

TASK 1: **Compute the entries marked (x) from the level book given below**

Station	Back Sight	Inter Sight	Fore Sight	Rise	Fall	Reduced Level (RL)
1	1.816	-	-	-	-	33.500
2	-	x	-	-	-	34.105
3	-	x	-	-	-	34.372
4	x	-	x	-	-	35.024
5	-	0.917	-	-	-	35.668
6	-	1.312	-	-	-	x
7	-	-	1.184	-	-	x

Solution

i R.L of Station 1 = 33.500

R.L of Station 2 = 34.105

Rise from station 1 to station 2 = 34.105 - 33.500 = 0.605m.

B.S on station 1 = 1.816

I.S on station 2 = 1.816 - 0.605 = 1.211

ii R.L of station 2 = 34.105

R.L of station 3 = 34.372

Rise from station 2 to station 3 = 34.372 - 34.105 = 0.267m.

I.S on station 2 = 1.211

I.S on station 3 = 1.211 - 0.267 = 0.944

iii Rise from station 3 to station 4 = 35.024 - 34.372 = 0.652m.

F.S on station 4 = 0.944 - 0.652 = 0.292

Rise from station 4 to station 5 = 35.668 - 35.024 = 0.644m.

B.Sc on station 4 = 0.917 + 0.644 = 1.561

iv Comparing I.S on station 5 and I.S and I.S on station 6 Fall from station 5 to station 6.

= 1.312 - 0.917 = 0.395

R.L of station 6 = 35.668 - 0.395 = 35.273.

v Compare I.S on station 6 and F.S on station 7, Rise from Station 6 to 7 = 1.312 - 1.184 = 0.128m.

R.L of station 7 = 35.273 + 0.128 = 35.401

vi Tabulate the Result.

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Station	Readings			Rise	Fall	R.L	Remarks
	B.S	I.S	F.S				
1	1.816					33.500	Starting point
2		1.211		0.605		34.105	
3		0.944		0.267		34.372	
4	1.561		0.292	0.652		35.024	C.O
5		0.917		0.644		35668	
6		1.312			0.395	35.273	
7				0.128		35.401	End point
Total	3.377		1.476	2.296	0.395		

— — — — — — — —

TASK 2 : **Arithmetic check**

Σ B.S - Σ F.S = Σ Rise - Σ Fall = Σ Last RL - 1 sr RL = 1.901 = 1.901 = 1.901

= 3.377 - 1.476 = 2.296 - 0.395 = 35.401 - 33.500

— — — — — — — —

TASK 3: **Solve the exercise and check**

Complete the entries marked (x) from the level book given below

Station	Readings			Rise	Fall	R.L	Remarks
	B.S	I.S	F.S				
1	3.202						B.M No 1
2	1.883		x		0.550		
3	2.204		2.853				
4	x		1.153				
5		0.420		1.606		653.908	B.M No.2
6	1.245		x		1.092		
7	1.793		0.719				
8	1.557		0.690				
9				x	1.065		B.M No 3

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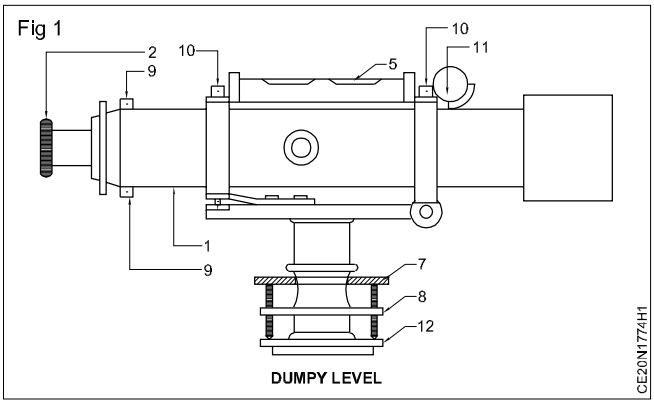
Practice levelling with different instruments

Objectives: At the end of this exercise you shall be able to
- **practice of levelling with dumpy level instrument**
- **practice of levelling with auto level instrument.**

PROCEDURE

TASK 1: **Practice on Dumpy level (Fig 1)**

Fig 1



DUMPY LEVEL

1 Use of this instrument has been defined in earlier exercise. Any how to have a second thought, view and parts of the object are shown.

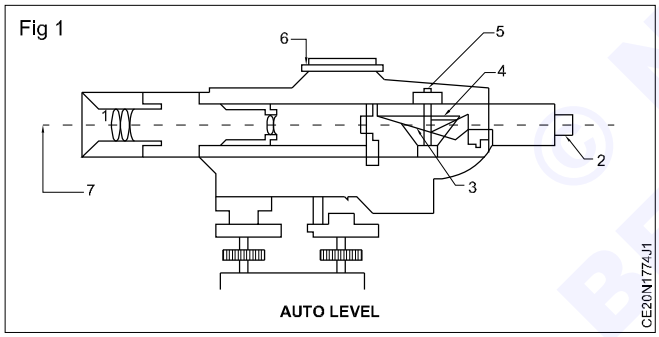
Trainee can recall this exercise and practice the same.

1. Telescope, 2. Eyepiece, 3. Ray shade, 4. Objective end, 5. Longitudinal bubble, 6. Focusing screws, 7. Foot screws, 8. Upper parallel plate (Tribrach), 9. Diaphragm adjusting screws, 10. Bubble tube adjusting screws, 11. Transverse bubble tube, 12. Foot plate. (Trivet stage)

— — — — — — — —

TASK 2: **Practice on Auto level (Fig 2)**

Fig 1



AUTO LEVEL

1 This is also done in earlier exercise. Even though it is practiced in earlier, again trainee can do the same and for his guidance, the view of parts of level is given below.

1 Objective, 2 Eyepiece, 3 Compensator object, 4 Compensator suspension, 5 Magnetic dampering system, 6 Line of sight.

— — — — — — — —

Check levelling

Objectives: At the end of this exercise you shall be able to
- **select on instrument position for the successive get up instrument**
- **find the reduced levels of all the given point**
- **calculate R.L by height of collimation method**
- **check the readings for accuracy.**

Refer Ex. No: 1 - 7 - 71 Task 1

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Longitudinal levelling or profile levelling and plotting

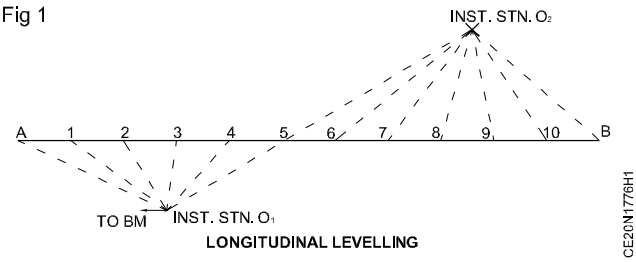
Objective: At the end of this exercise you shall be able to
- **determine the reduced levels of points at known distance along the given route.**

PROCEDURE

TASK 1: **Longitudinal levelling**

1 Mark the end points of the centre line AB with ranging rods (Fig 1)

Fig 1



2 Measure the direction of the line using any angular measuring instrument.

3 Measure the length o the line AB using tape and erect pegs at an interval of 200 m along the line AB. Also erect pegs at the points where the ground level changes abruptly.

4 Set up and levels the instrument at a suitable point '01' from where maximum number of observations is possible.

5 Take a BS reading on the bench mark and intermediate sights on the longitudinal section points.

6 Also take a foresight reading on a suitable change point on account of the length of sight being beyond the power of the telescope.

7 Shift the instruments to a suitable position and carry out the temporary adjustments.

8 Take a BS reading on the change point and continue the process until the last point is reached.

9 Record the readings in the respective columns as soon as they are taken, in the following tabular form.

10 Calculate the reduced levels of the points by height of instrument method.

Work should always commence from a bench mark and should end on a bench mark.

Station	Chainage	Bearing		BS	IS	FS	HI	RL	Remarks
		FB	BB						

Plotting of longitudinal section

Objective: At the end of this exercise you shall be able to
- **prepare the longitudinal section of the route.**

TASK 1: **Plot the longitudinal section of the route**

1 Read and interpret the chainages and levels of the route. (Fig 1)

2 Select a suitable horizontal scale (1.1000) and a vertical scale. (1.100)

3 Draw a horizontal line of length 20cm, equal to the length of the section line.

4 Mark the longitudinal section points on this line and also note the chainages of these points.

5 Note the reduced levels of the ground points against the respective chainages points.

6 Draw another horizontal line parallel and equal to the first, keeping a vertical distance of 2cm, representing the datum line.

7 Choose a suitable datum level 676.000.

(Datum level should be selected in such a way that the length of the ordinate should be between 4cm to 15cm)

8 Mark the longitudinal section points on the datum line.

9 Draw vertical lines through these points.

10 Scale off the ground level and mark the ground levels on the respective lines.

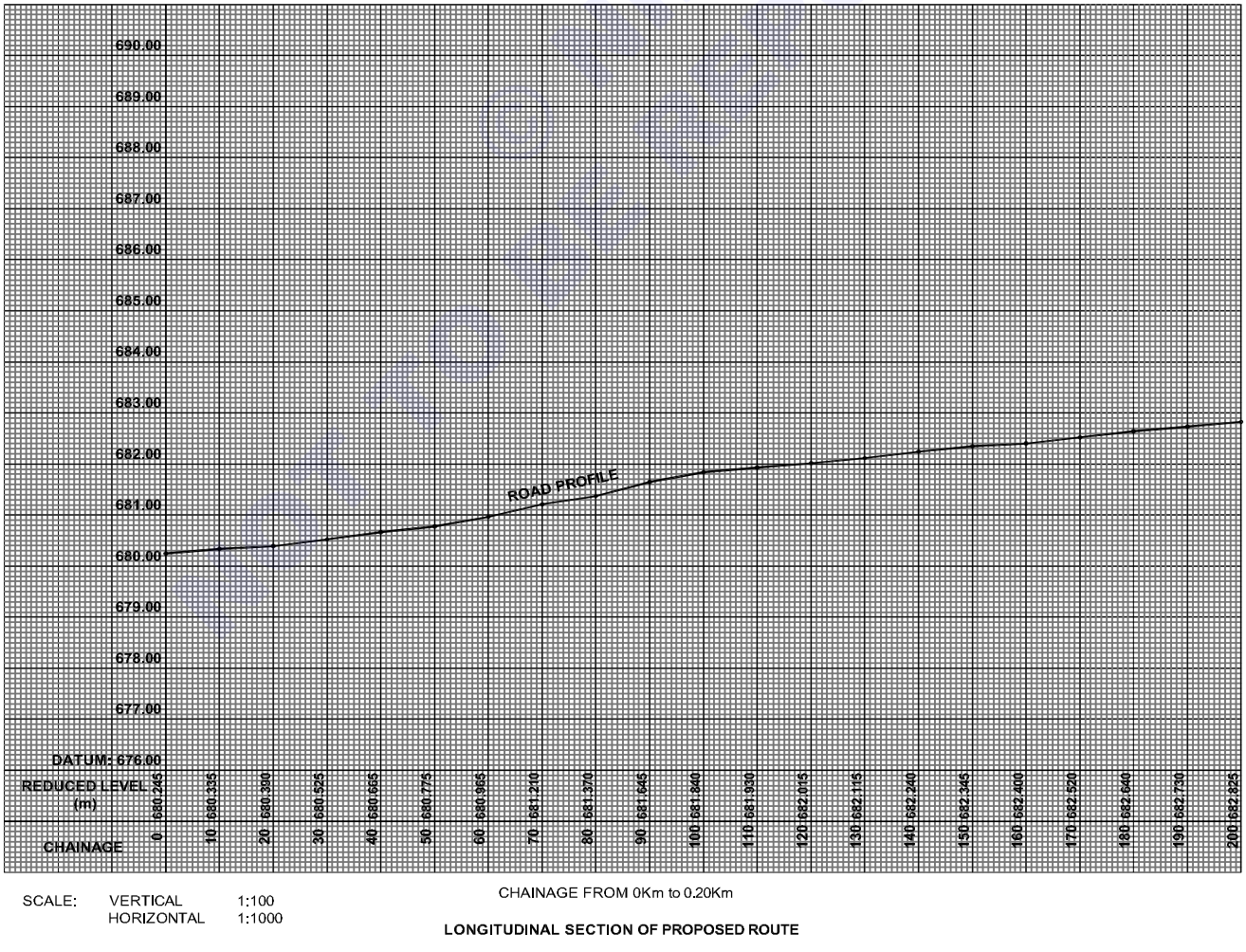
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11 Join these points by straight lines of get the outline of the ground surface.

The datum line and ground line are drawn in black and the perpendicular lines in thin blue lines.

Chainage	Ground level
0	680.245
1	680.335
20	680.395
30	680.525
40	680.665
50	680.775
60	680.965
70	681.210
80	681.370
90	681.645
100	681.840
110	681.930
120	682.015
130	682.115
140	682.240
150	682.345
160	682.400
170	682.520
180	682.640
190	682.730
200	682.825

Fig 1



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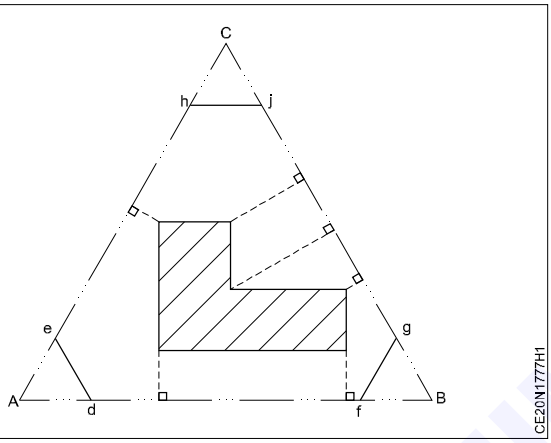
Surveying of a building site with chain and Levelling Instrument with a view to computing earth work

Objectives: At the end of this exercise you shall be able to
- **chain survey around a given small building by triangulation**
- **chain survey around a given small building by traversing**
- **chain survey around a given small building by traversing using chain angle method.**

PROCEDURE

TASK 1: **Chain survey around a given small building by triangulation (Fig 1)**

Fig 1



Field work

1 Prepare a rough sketch of the given small building in the field book.

2 Fix the triangulation station points A,B and C around the building which are intervisible.

3 Prepare reference sketches to station A,B and C.

4 Run the chain line from A to B.

5 Take chainages and offsets of the corners of the building and enter in the field book.

6 Mark a point ‘d’ & ‘f’ on the chainline AB to check chain angle.

7 Similarly follow the same procedure for chain lines ‘BC’ and ‘CA’.

8 Also mark a points ‘g’ and ‘j’ on the chainline ‘BC’ and ‘e’ and ‘h’ on the chainline ‘CA’ and fix arrows.

9 Measure checklines distance ‘de’, ‘fg’ and ‘hj’ and enter in the field book.

Office work

10 Draw the chianline ‘AB’ to a suitable scale on the drawing sheet.

11 Draw an arc of radius equal to AC with centre ‘A’.

12 Draw an arc of radius equal to BC with centre ‘B’.

13 Denote the point ‘c’ where the above arcs meet each other.

14 Join AC and BC.

15 Mark the checkline points ‘d’ and ‘f’ on the chainline ‘AB’.

16 Similarly mark the checkline points g,j and ‘h’ ‘e’ on the checkline BC and CA respectively.

17 Measure the checkline distance ‘de’ , ‘hj’ and ‘gf’ in the drawing.

18 Check the measured distance with field measurements for accuracy of the frame work.

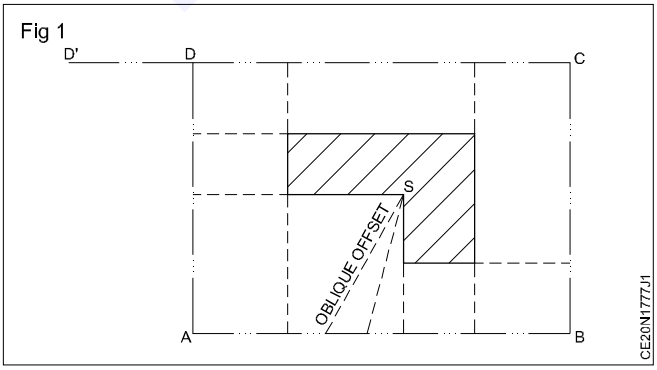
19 Plot the chaniages and offsets to all chainlines according to the field book.

20 Join all the offsets point to get the actual shape of the building.

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TASK 2: **Chain survey around a given small building by traversing (Fig 1)**

Fig 1



Field work

1 Prepare a rough sketch of the given small building in the field book.

2 Select and fix survey stations ‘A’ and ‘B’ which are intervisible to each other.

3 Prepare reference sketches to station ‘A’ and ‘B’.

4 Run the chain line from A to B for a known length.

5 Note the chainages and measure the offsets.

6 Enter the chainages and offsets in the field book.

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7 Locate the interior corner (s) of the building by taking oblique offsets from any two fixed round chainages.

8 Locate the station ‘c’ by sighting station ‘A’ using the cross staff at B.

9 Run the chainline from B to C and locate the details along BC.

10 From station ‘c’ erect perpendicular line ‘CD’ to ‘BC’ which is approximately equal in length ‘AB’.

11 Fix a ranging rod on ‘D’.

12 Fix a cross staff at ‘A’ and sight ‘B’.

13 Move the ranging rod along CD to locate D by sighting through the another Groove in the cross staff at A.

14 Run the chainlines from C to D and locate the details along CD.

15 Similarly, Run the chianline from D to A, and locate the details along DA.

Office work

16 Draw a chainline ‘AB’ to a suitable scale.

17 Draw a perpendicular line to AB from B for a distance BC to locate ‘C’.

18 Similarly locate the station D and check it from station A.

19 Mark the chainages on the correspond chain lines.

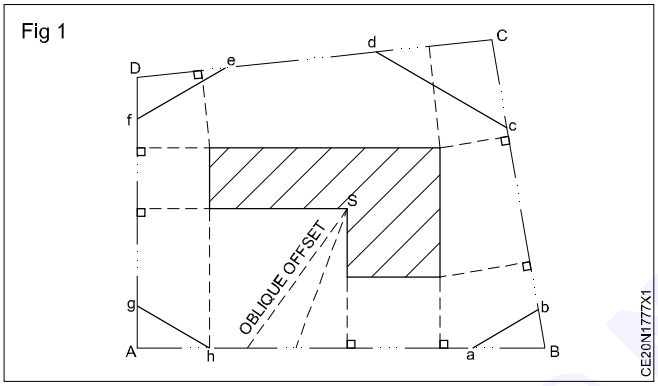
20 Draw the offsets from the correspond chainlines.

21 Connect all the offset points to get the actual outlines of the buildings.

— — — — — — — —

TASK 3: **Chain survey around a given small building by traversing using chain angle method (Fig 1)**

Fig 1



Field Work

1 Prepare a rough sketch of the given small building in the field book.

2 Fix survey stations A and B which are intervisible to each other.

3 Prepare reference sketches to the station A and B.

4 Run a chain line from A to B to a known length and note the chainages.

5 Measure the offsets and enter in the field book.

6 Fix a check line point ‘a’ on the chainline ‘AB’ where more than 3m from station B and fix an arrow.

7 According to the ground conditions run the chainline from B to C at any angle using chain angle method.

8 Take chainages and offsets on the chainline BC.

9 Fix a chainline point ‘b’ in the chain line BC.

10 Measure the distance ‘ab’ and enter in the field book.

Use chain angle method when the chain line is not possible to run at right angle to each other.

11 Similarly follow the above procedure for the chain lines CD and Da.

Office work

12 Draw the chain line AB to a suitable scale.

13 Mark the chain lines and offsets on the chainline AB as per field book measurements.

14 Mark the check line point ‘a’ on the chainline AB.

15 Draw an arc with centre as ‘a’ and radii as ‘ab’.

16 Draw another arc with centre as B and radii as ‘Bb’.

17 Denote the checkline point ‘b’ where the above two are intersect each other.

18 Join Bb and prolong it up to station C.

19 Mark the chainages and offsets on the chain line BC.

20 Follow the above procedure for remaining chain lines CD and DA.

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Contour - direct & indirect methods

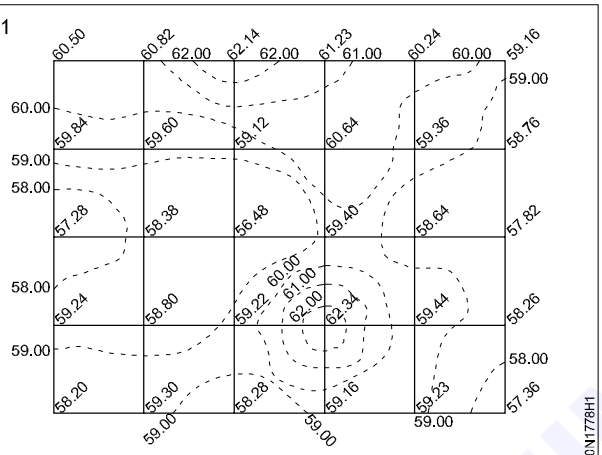
Objectives: At the end of this exercise you shall be able to
- **determine the reduced levels of points**
- **establish various direction using compass and draw the contour lines.**

PROCEDURE

TASK 1: **Indirect contouring square method**

1 Divide the whole area into a number of squares of side 10m. (Fig 1)

Fig 1



2 Erect pegs at corners of these squares.

3 Establish a bench mark near the centre of the area.

4 Set up and level the dumpy level at convenient position.

5 Take a BS reading on the bench mark. Also take staff readings on various points on the corner of the squares.

6 Record the staff readings and corresponding distance in a systematic way.

7 Determine the reduced levels of these points by height of collimation method.

8 Select a suitable scale.

9 Plot the squares and write the corresponding reduced levels of corner points.

10 Read and interpret the reduced levels.

11 Decide the contour lines that are to be plotted on the plan from the spot levels.

12 Locate the contour points by arithmetic method interpolation.

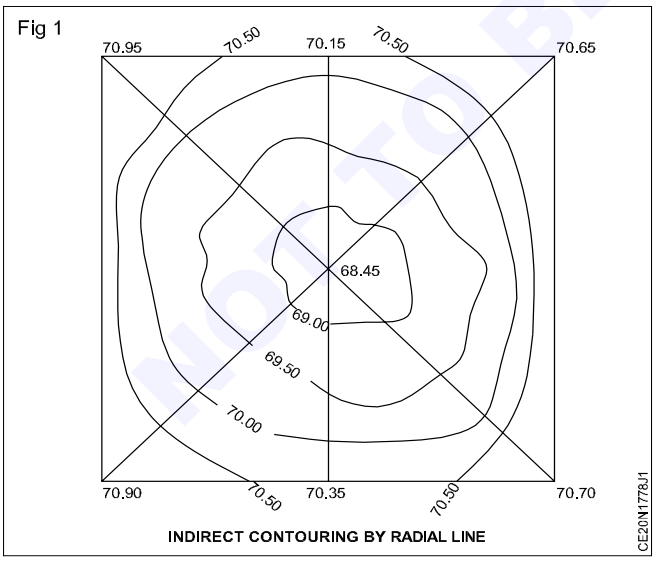
13 Join the points of some reduced levels with free line to get the contour lines.

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TASK 2: **Direct contouring by radial line using compass**

1 Select a point at the centre of the area. (Fig 1)

Fig 1



2 Set up the compass over this and carry out the temporary adjustments.

3 Establish a number of radial lines at an angular interval of 60.

4 Measure the length of these radial lines using tape.

5 Set up an level of these radial lines using tape.

6 Establish a temporary bench mark near the centre point.

7 Take a BS readings on the bench mark.

8 Also take staff readings t centre point and at the ends of each radial line.

9 Calculate the reduced levels of these points.

10 Fix the reduced levels of points that are to be located on each radial line.

11 Calculate the staff required to locate a particular contour point i.e staff reading = height of instrument induced level of contour.

12 Hold staff on an estimated position on the radial line and take the staff reading. Move the staff forward or backward till the required staff readings is obtained.

13 Mark the point with a peg and measure the distance of the point from the centre.

14 Similarly mark various contour points on each radial point.

15 Repeat the process on all times.

16 The points are then plotted on the plan to a suitable scale.

17 The contour lines are drawn by joining the corresponding points by dotted curved lines.

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Make topography map, contours map

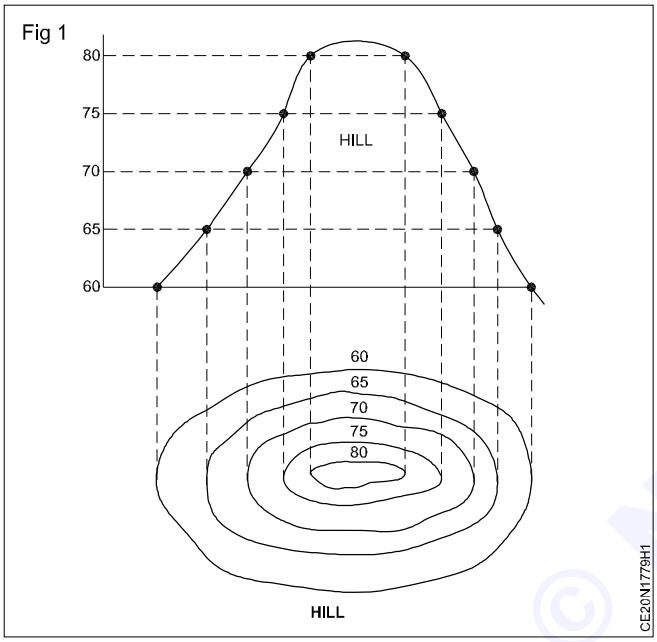
Objective: At the end of this exercise you shall be able to
- **reading a map.**

PROCEDURE

TASK 1: **Reading a map of contour in a map**

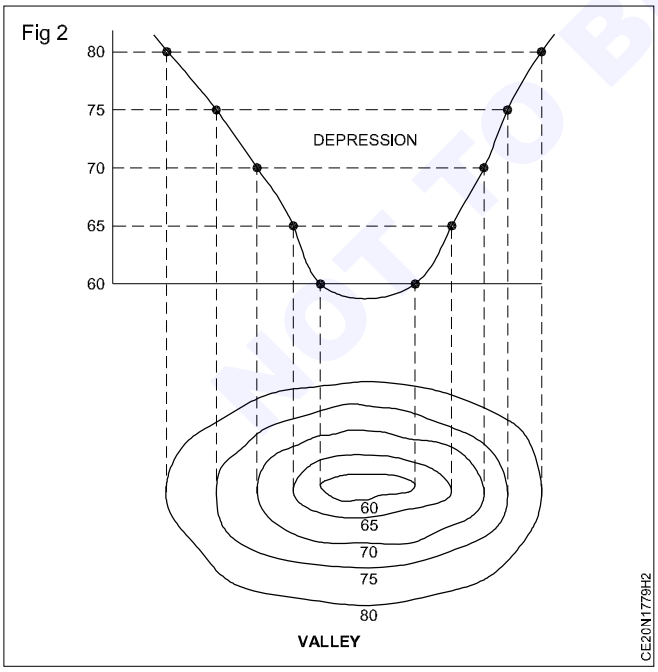
1 In a series of closed contour lines, if the higher values are inside (Fig 1). It represents a hill.

Fig 1



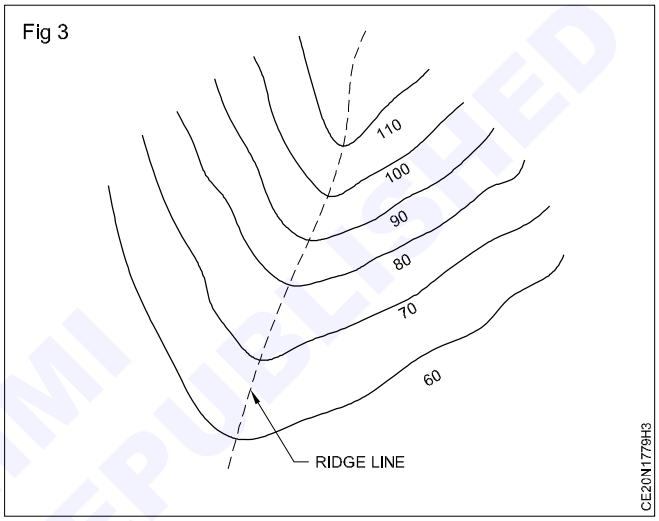
2 In a series of closed contour lines, if the higher values are outside (Fig 2) it indicates a depression.

Fig 2



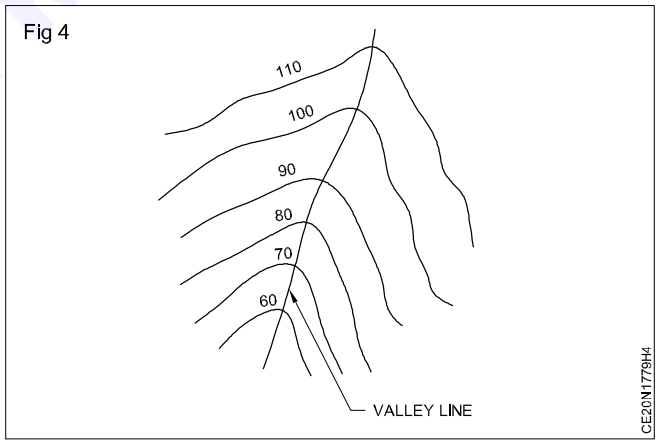
3 In a series of contour lines, if the higher values are inside the a bend or loop, it represents a Ridge line. (Fig 3)

Fig 3



4 In a series of contour lines if the higher values are out side the bend it indicates a valley. (Fig 4)

Fig 4



5 In a series of contour lines, if the lines are not merging or crossing one another represents a over hanging cliff. (Fig 5)

6 In a series of contour lines if the contour lines are not run into one another, except in the case of a vertical cliff. (Fig 6)

7 Map (Fig 7)

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Fig 5

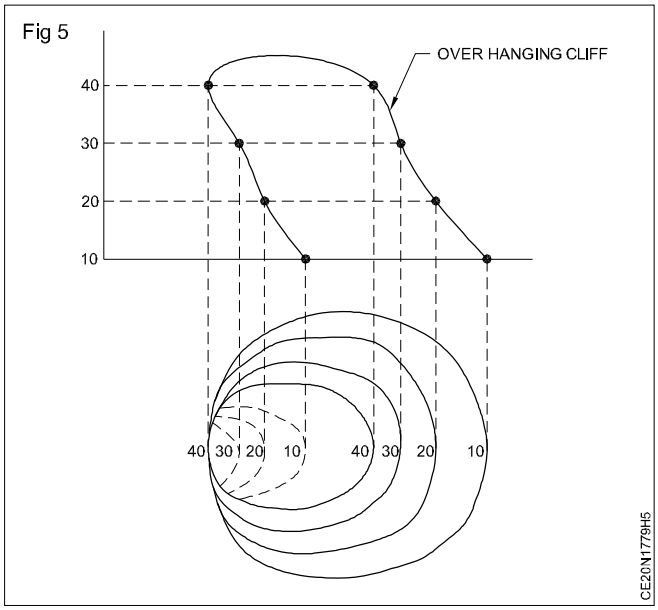


Fig 6

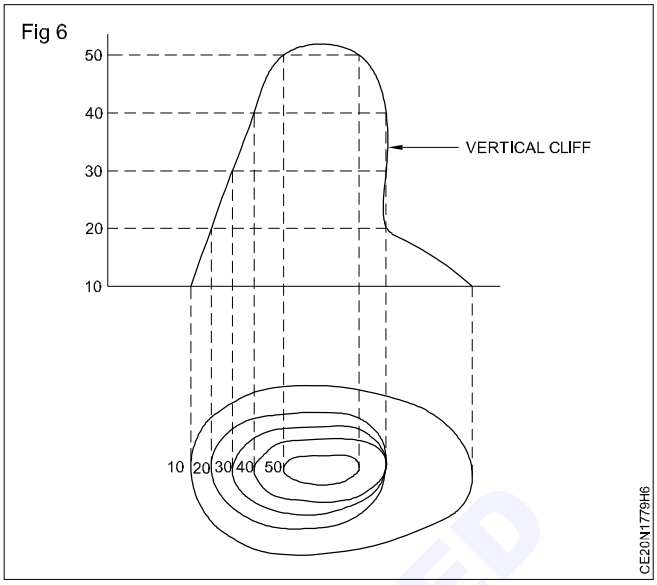
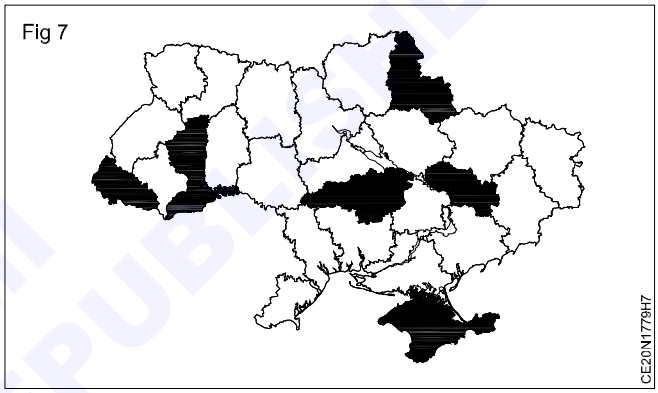


Fig 7



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Trigonometric levelling - base of the object accessible (object vertical)

Objectives: At the end of this exercise you shall be able to
- **operate the instrument**
- **measure the distance between base of the vertical object and the instrument station**
- **find the reduced level of the point Y at the top of the building.**

PROCEDURE

TASK 1: **Trigonometric levelling**

1 Select an instrument station 'O' on a fairly open ground at a reasonable distance from the base of 'Y'. (Fig 1)

2 Set up the instrument at 'O'.

3 Perform all the temporary adjustments.

4 Set the vertical vernier 0-0.

5 Direct the telescope to the staff vertically hold at the given BM (check altitude bubble).

6 Clamp both plats. Exactly bisect the staff.

7 Observe the staff reading (S) and enter it in the table.

8 Loosen the lower clamp turn the telescope towards 'Y'.

9 Lock lower clamp, tighten the vertical circle clamping screw.

10 Bisect 'Y' exactly using tangent of vertical circle clamping screw and lower screw.

11 Observe vertical angle (q) in both scales and enter it in the respective columns. (check altitude bubble).

12 Change face of the instrument and observe the vertical angle to 'Y'.

13 Average of the angles in C and D scale is the vertical angle (q).

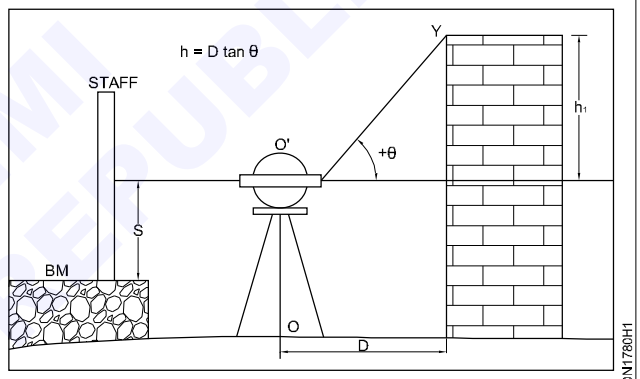
14 Measure the horizontal distance (D) between the instrument station 'O' and base of the point 'Y' using tape.

15 Find reduced level of the point 'Y'.

RL of Y = RL of BM + S + h1

If staff reading observed is different, take average of the staff readings as 'S'.

Fig 1



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Tabular column for trigonometric levelling

Instrument	Sight to	Length (m)	Face Left						Face Right						Average vertical angle			Rough sketch
			C	D	Mean	Vertical angle			C	D	Mean	Vertical angle						
			° ' "	' "	° ' "	° ' "			' "	"	° ' "	' "			° ' "			

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Prepare a road project (open traverse)

Objective: At the end of this exercise you shall be able to
- **prepare a road map with details along the road.**

PROCEDURE

TASK 1: **Prepare a road map with details along the road**

1 Make a visit to the existing road for the purpose of identifying the objects and special features located on the sides of road to be surveyed. (Fig 1)

2 Select an instrument station ‘A’ at the beginning of road which gives maximum details for mapping.

3 Select the other stations B,C,D etc.

4 Setup the instrument over the selected station ‘A’.

5 Fix a ranging rod at station ‘B’.

6 Sight station ‘B’ and take the bearing and note it in the field book.

7 Run the chain along ‘AB’ and take offsets of the objects on both sides of the road.

8 Observations should be recorded in the field book.

9 Shift the instruments to station ‘B’.

10 Take the bearing by back sighting ‘A’.

11 Check it with the fore bearings of ‘AB’.

12 Fix a ranging rod at ‘C’.

13 Sight station ‘C’ and take the bearing of ‘BC’ and enter it.

14 Run the chain along BC and take offsets of objects on both sides of the road.

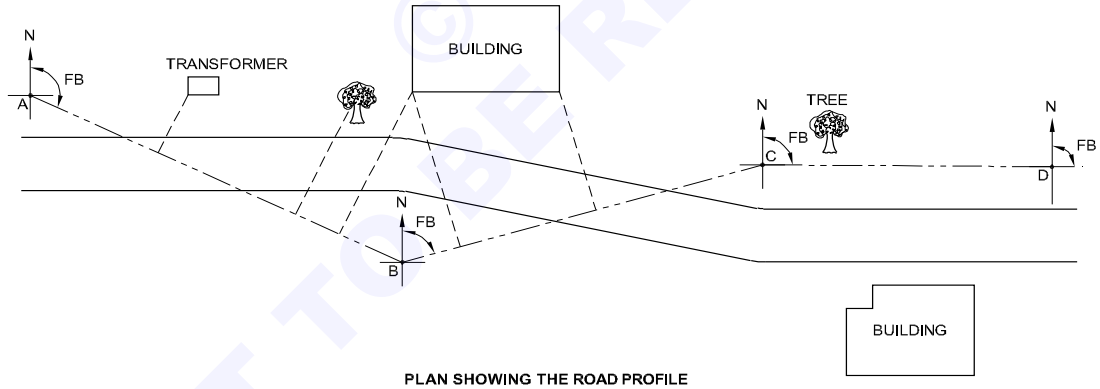
15 All the bearings should be entered in the field book as per the table given below.

16 The offsets taken for different objects are entered as a chain survey field book.

17 Plot the road map based on the bearings and offsets.

Run the survey line along the sides of the road only, to avoid traffic problems.

Fig 1



PLAN SHOWING THE ROAD PROFILE

CE20N1781H1

Model tabulation

Instrument at	Sight to	Distance in metre	Bearing	Remarks
A	B			AB
B	A			BA
	C			BC
C	B			CB
	D			CD

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TASK 2: **Map study (road project)**

1 Mark the various possible routes on the map connecting the terminal points observing the criteria of route selection.

2 Study well various routes by conducting reconnaissance survey.

— — — — — — — —

TASK 3: **Reconnaissance survey (road project)**

1 Measure the magnetic bearing of the lines of the alignment by a prismatic compass and note in the field book.

2 Measure the distance along the alignment approximately by pacing.

3 Note the objects and nature of the ground on both sides of the alignment upto 50m on the field book.

4 Avoid obstacles like religious places or valuable structure if any while fixing alignment.

5 Avoid crossing the alignment obliquely over the river by diverting the alignment suitably.

6 Note all other important points like the railway crossing, cancel crossing, etc.

7 Collect the HFL (High Flood Level) ever attained and the discharge records for the last few year from the appropriate authorities to design the culverts and bridges.

8 Prepare preliminary records of properties eligible for compensation.

— — — — — — — —

TASK 4: **Preliminary survey (road project)**

1 After fixing suitable alignment construct a pillar at the starting point of the alignment of the road which is already fixed by reconnaissance survey.

2 Conduct by fly level to connect the near by GTS bench mark with the starting point of the road project.

3 Conduct a prismatic compass survey or plane table survey to prepare route survey map covering about 50M on both sides of the alignment.

4 Conduct a longitudinal map levelling along the alignment at regular interval (say 20 or 40m).

5 Take cross sections at regular intervals. (say 100m)

6 Establish permanent bench marks at suitable places along the alignment for future reference.

7 Take cross sections of the rivers, etc accurately.

8 Prepare the following drawings:

a Route survey map.

b Longitudinal map section with formation levels.

c Cross sections with formation width and sole slope.

d Contour map of the strip of land along alignment.

e Design of curves with setting out tables.

f Mass diagram for the earthwork.

— — — — — — — —

TASK 5 : **Location survey (road project)**

1 Fix the centre line of the road after selecting the most economical alignment by stout pegs or pillars at intervals of 30m.

2 Mark the total land width required by pillars at regulars intervals. (say 30m)

3 Mark tangent points and intersection points of the curves by pillars.

— — — — — — — —

TASK 6 : **Construction survey (road project)**

1 After location survey retrace the centre line shown on the plan and referencing centering points on the curve.

2 Check bench marks, running centerline levels over the retraced lines.

3 Take elevations at all stations, at all breaks on the ground and at other points where it is necessary to take cross section for volume granitites.

4 Set slope stakes and grade stakes.

5 Set stakes for complete layout of culverts and bridges.

6 Set out curves.

7 Report and make advantageous changes, if any in line grade or minor adjustment of the drainage structure.

8 Reset the stakes that have been destroyed as the progresses.

— — — — — — — —

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Field work of theodolite

Objectives: At the end of this exercise you shall be able to
- **unplace and place theodolite from and to the theodolite box respectively**
- **fix and unfix theodolite to and from the tripod respectively**
- **identify parts of the theodolite.**

PROCEDURE

TASK 1: **Unplace and place theodolite from as to the box**

1 Tripod is placed on a firm ground at a convenient height with the tripod legs set well apart.
2 Set two legs of the tripod firmly into the ground.
3 Adjust the third leg in circumferential directions so that the top of the tripod becomes approximately horizontal.
4 Open the instrument box.
5 Note how the instrument is placed in the box.
6 Take out the instrument from the box. Hold it with right hand.
7 Turning the trivet in clockwise direction, screw the instrument firmly on the tripod.
8 Study parts of the theodolite.
9 Remove the theodolite from the tripod by turning the trivet in anticlockwise direction.
10 Loosen all screws.
11 Place the theodolite in the box safely.

Temporary adjustments of theodolite

Objectives: At the end of this exercise you shall be able to
- **setup the theodolite level, theodolite and eliminate parallax .**

TASK 1: **Approximate levelling**

1 Fix an instrument station on the ground.
2 Tripod is placed over the station at a convenient height with the tripod legs set well apart.
3 Set two legs firmly into the ground.
4 Adjust the third leg so that the top of the tripod becomes approximately level (level can be checked by eye judgement).

Fixing the instrument

1 Fix the theodolite over the tripod head.
2 Suspend a plumb bob from the hook attached to the vertical axis of the theodolite.

Centering

1 One of the legs of the tripod moved radially to bring the plumb bob exactly over the station.
2 The leg is pushed into the ground.

Levelling up

1 Bring the plate level tube parallel to the line joining any two foot screws.
2 Bring the bubbles to the centre of its run by moving these two foot screws either inwards of outwards.
3 Turn the telescope through 90^0 so that the bubble tube lies over the third foot screw.
4 Turn this screw inward or outward and bring the bubble of the plate level tube to the centre of its run.
5 Turn the telescope to its original position by rotating through 90° and check the bubble. Repeat the steps 2 to 4 till bubble is central in both the positions of the bubble tube.

— — — — — — — —

TASK 2: **Elimination of parallax**

Focusing the eyepiece

1 Remove the lid of the telescope.
2 Hold a white paper in front of the telescope (or direct the telescope to the sky) and move eye piece inwards or outwards till the cross hairs are seen distinct and sharp.

Focusing the object glass

1 Direct the telescope towards the object.
2 The focusing screw is turned until the object appear clear and sharp.

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Measuring a horizontal angle (ordinary method) vertical angle, magnetic bearing of a line

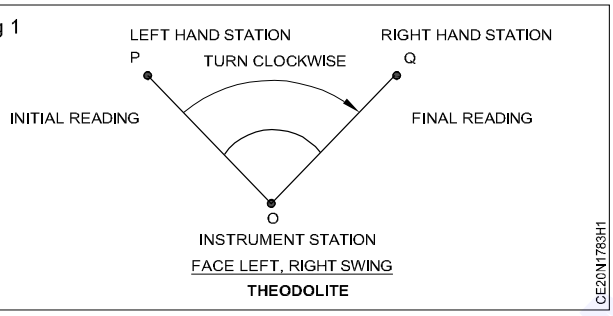
Objectives: At the end of this exercise you shall be able to
- **measuring horizontal angle and vertical angle**
- **measuring magnetic bearing of a line.**

PROCEDURE

TASK 1: **Measuring a horizontal angle (ordinary method)**

1 Erect two stations P and Q by driving pegs on the field and erect ranging rods vertically behind the pegs. (Fig 1)

Fig 1



2 Fix an instrument station O.

3 Set up the instrument over the station O with telescope in normal condition. (vertical circle left of the observer and bubble is up)

4 Perform all the temporary adjustments.

5 Release both upper and lower clamps.

6 Turn the upper plate until the index of vernier of 'A' nearly coincides with the zero of the main scale. Lock the upper clamp.

7 Turn the upper tangent (slow motion) screw to make the two zeros exactly coincident.

- After setting 00°00'00" on 'A' scale, check the reading on the 'B' of main scale, which should read 180°00'00" if there is no instrumental error

8 Unclamp the lower clamping screws.

9 Direct the telescope to sight the ranging rod at the left hand station (P) and bisect the station.

- Approximate bisection of the station is done by sighting over the telescope through a pin- and -hole arrangement provided over the top of the telescope.

10 Lock the lower clamp.

11 Bisect the station P exactly by using the tangent screw.

- For exact bisection - bringing the station mark exactly at the intersection of horizontal and vertical hairs - of the station, vertical circle clamp and its tangent have to use.

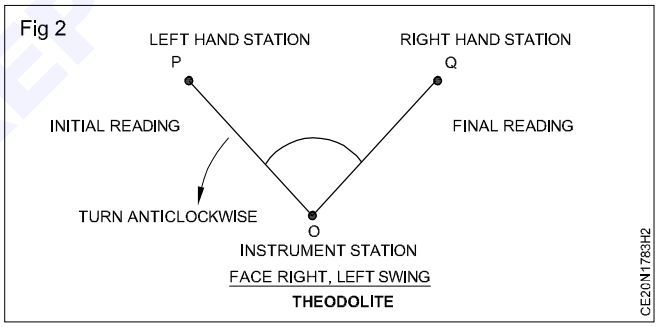
12 Once more check both the verniers A and B and ensure readings remain unchanged.

13 Enter readings in the respective columns of table in theodolite field book. Say 0°00'00"

- A' scale reading is entered fully. i.e in degree, minutes & seconds while only minutes and seconds of 'B' scale are entered

14 Release the upper clamp and swing the telescope to bisect the station 'Q'. (Fig 2)

Fig 2



15 Lock the upper clamp and get exact bisection using upper tangent screw.

16 Read and enter readings in the respective columns of the Table - 1.

17 Change face of the instrument by transiting and swinging.

18 Follow steps 5 to 15.

19 Angle POQ is the average of angles obtained from both face observations.

20 Loosen all clamps. Remove the theodolite from the tripod and gently place it in the box.

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INSTRUMENT	SIGHT TO	FACE LEFT				FACE RIGHT				Average horizontal ANGLE	Rough sketch
		A	B	MEAN	HORIZONTAL ANGLE	A	B	MEAN	HORIZONTAL ANGLE		
		0 ' "	' "	0 ' "	0 ' "	0 ' "	' "	0 ' "	0 ' "		

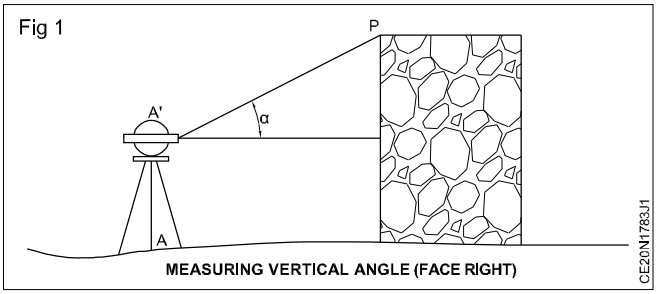
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TASK 2: **Measuring a vertical angle (Angle of Elevation)**

1 Erect a station a by driving peg on an open and fair ground.

2 Set up the instrument at A. (Fig 1)

Fig 1

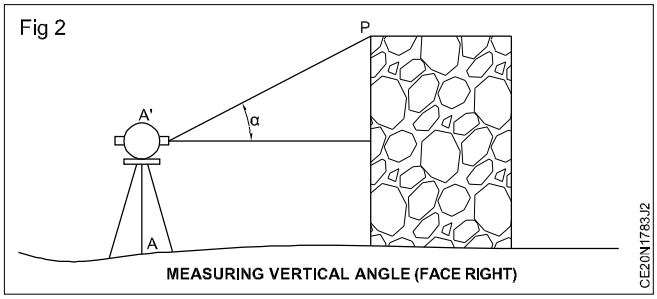


3 Perform all the temporary adjustments.

4 Level the instrument with respect to altitude bubble level. (steps for keeping the plate bubble parallel is followed. but Instead of bringing plate level parallel and perpendicular, bring altitude bubble)

5 Direct the telescope upwards to sight 'P' (Fig 2)

Fig 2



6 Lock horizontal movement of plates.

7 Tighten vertical clamp screw.

8 Bisect 'P' exactly using tangent screws.

9 Measure vertical angle, +a from C scale and D scale.

10 Record the readings with sign.

11 Mean reading is the vertical angle.

12 Change face of the instrument and measure vertical angle following appropriate above steps.

13 Average of both face readings is the angle of elevation (+a) to 'P' from 'A'.

— — — — — — — —

TASK 3: **Reading magnetic bearing of a line**

1 Set up the instrument over 'A' and level it accurately.

2 Set the vernier A to the zero of the horizontal circle.

3 Release the magnetic needle and loosen the lower clamps.

4 Rotate the instrument in the horizontal plane until the magnetic needle takes the normal position.

The zeros of the scales in the trough compass or the N and S graduation in the triangle box compass or the under mark in the tabular compass are opposite to the ends of the needle.

5 Tight the lower clamp and use its tangent screw for act coincidence.

6 The line of sight is now parallel to the magnetic meridian and the vernier A reads zero.

7 Loosen the upper clamp. Turn the telescope and sight the object B.

8 Bisect B exactly by using upper tangent screws.

9 Road both verniers are the horizontal circle.

10 The mean of the two vernier readings gives the bearings of the line AB.

11 If greater accuracy is needed, change the facw, take a second reading and record the mean of the two.

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Instrument	Sight to	Length (m)	Face left Right Swing									Face Right Left Swing										Average Horizontal Angle			Rough Sketch
			A			B			Mean			No of repti tions	Horizontal angle			A			B			Mean			No.of repti tions	Horizontal angle						
			0	‘	“	‘	“	0	‘	“		0	‘	“	0	‘	“	‘	“	0	‘	“		0	‘	“	0	‘	“	

INSTRUMENT	SIGHT TO	FACE LEFT												FACE RIGHT												Average vertical			Rough sketch
		A			B			MEAN			HORIZONTAL ANGLE			A			B			MEAN			HORIZONTAL ANGLE						
		0	‘	“	‘	“	0	‘	“	0	‘	“		0	‘	“	‘	“	0	‘	“	0	‘	“					

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Levelling with a theodolite (simple levelling)

Objectives: At the end of this exercise you shall be able to
- **operate theodolite**
- **observe and tabulate staff readings**
- **find the reduced levels of the given points.**

Requirements

Tools/Instruments

- Theodolite with tripod - 1 No each.
- Levelling staff - 1 No.
- Plumb bob - 1 No.
- Measuring tape - 1 No.
- Peg - 1 No.
- Hammer - 1 No.

Materials

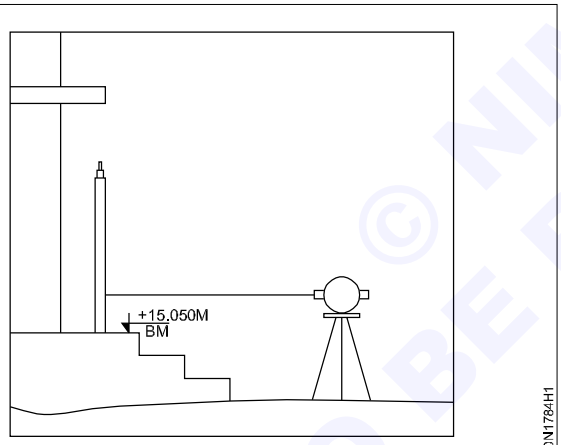
- White paper - 1 No.

PROCEDURE

TASK 1: **Simple levelling**

1 Find suitable ground point so that the points to be sighted can be well commanded. (Fig 1)

Fig 1



SIMPLE LEVELLING

2 Perform all the temporary adjustments.

3 Make zero of the vertical circle coincide with zero of the vertical circle.

4 Clamp the vertical clamping screw and using its tangent make the reading 0-0.

5 Check whether the altitude bubble is in central position. (If bubble is out of the centre, bring the bubble to central position using the foot screw near to the telescope).

6 Hold the staff vertically over the given BM. (RL is +15.050m)

7 Direct the telescope towards the staff.

8 Arrest the horizontal motion. Exact bisection is done using the lower tangent screw.

9 The reading on the staff corresponding to the exact bisection of the middle horizontal hair and vertical cross wire is recorded (BS).

10 Hold the staff on the given point, of which RL has to be found.

11 Loosen the lower screw direct the telescope towards the staff.

12 Lock the lower clamp. Exact bisection is done using the lower tangent screw.

13 Check whether the altitude bubble is in central position.

14 Record the reading (IS).

15 Similarly take staff reading (s) of the given points and record it. (IS and reading taken just before changing the HI of instrument, FS)

16 Find the reduced levels of the points by any of the methods.

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Calculation of area from traverse

Objectives: At the end of this exercise you shall be able to
- **calculate the independent co-ordinates**
- **calculate the area of traverse ABCD.**

PROCEDURE

TASK 1: **Calculate the independent co-ordinates**

1 Given the altitude and departures of the sides of a closed traverse ABCD.

Side	Latitudes in Metres		Departure in Metres	
	N	S	E	W
AB	107.4		62.0	
BC		122.6	102.9	
CD		77.9		45.0
DA	93.1			119.9

Solution

Take the co-ordinates of A (each multiple of 100 or 1000) the co-ordinates of other points are positive.

Take the whole traverse lives in the first (NE) quadrant Take co-ordinates A as 200 and 100.

North co-ordination of A=200.00
(Assessment)

Add northing of B	= 107.40
North co-ordinate of B	= 307.40
Deduct southing of C	= 122.60
North Co-ordinate of C	= 184.80
Deduct southing of D	= 77.90
North co-ordinate of D	= 106.90
Add northing of A	= 93.10
Check Northing co-ordinate of A (same as answered)	= 200.00
East co-ordinate of A	= 100.00
Add easting of B	= 62.00
East co-ordinate of B	= 162.00
Add easting of C	= 102.90
Easting co-ordinate of C	= 264.90
Deduct wasting of D	= 45.00
East co-ordinates of D	= 219.90
Deduct wasting of A	= 119.90
Check east co-ordinate of A (same as answered)	= 100.00

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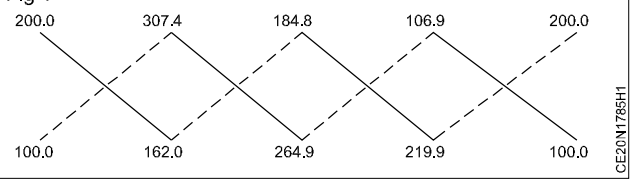
TASK 2: **Calculate the area of traverse ABCD**

1 The independent co-ordinates of points are

Points	Northing	Easting
A	200.00	100.00
B	307.40	162.00
C	184.80	264.90
D	106.90	219.90
E	200.00	100.00

2 Arrange the co-ordinates in the determinate form. (Fig 1)

Fig 1



Area = 1/2 [{(200.0x162.0) - (307.4x100.0)} +
{(307.4x264.9) - (184.8x162.0)} +
{(184.8x219.9) - (106.9x264.9)
+ {(106.9x100) - (200.0x219.9)}]
= 1/2 [(32400 - 30740) + (81430 - 29938)
+ (40638 - 28318) + (10690 - 43980)
= 16091 sq.metres.

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Determination of height

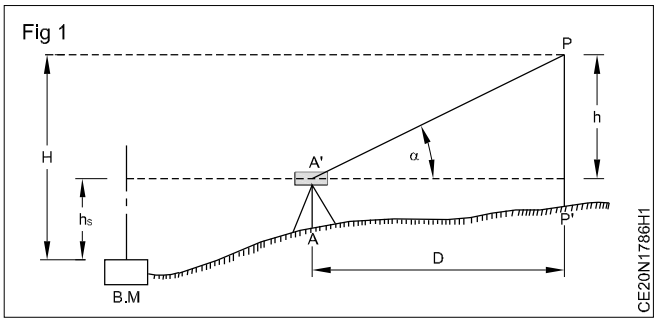
Objectives: At the end of this exercise you shall be able to
- **define the base of the object is accessible.**

PROCEDURE

TASK 1: **The base of the object is accessible**

1 Keep the height of the object above the bench mark. (Fig 1)

Fig 1



Let

H = the height of the objects above B.M.

h = the height of the object above the instrument axis.

h_s = height of instrument axis above the B.M.

α = the vertical angle observe at the instrument - station.

D = the horizontal distance in metres measurement from the instrument station to the base to the object.

$h = D \tan \alpha$

$H = h + h_s = D \tan\alpha + h_s$

'D' distance is large.

The correction of curvature

$$0.0673 \left(\frac{D}{1000}\right)^2$$

2 Apply the above formula.

3 Find the height of the object above the instrument station.

4 Add the height of the instrument axis to the height of the object above the instrument axis.

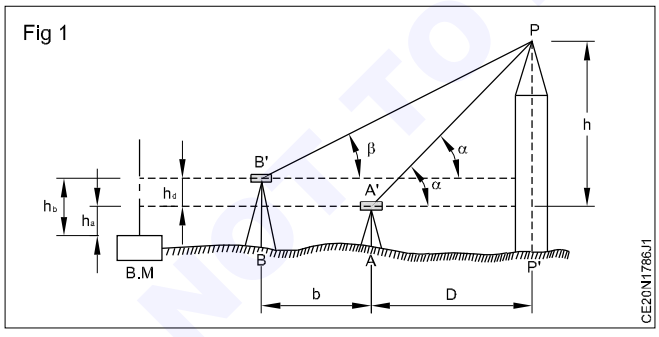
5 Obtained the height of the instrument axis in the wags.

6 Measure the height of centre of the eye - piece above the station point by steel tape.

7 Read the staff through the object - glars when held just near the eyes - piece end.

TASK 2: **The base of the object is inaccessible (Fig 1)**

Fig 1



1 Find the height of the object above a Bench mark. (B.M)

2 Choose two stations A and B suitable on level ground.

3 Set up the instrument over the station A and level it accurately.

4 Set the altitude bubble centre.

5 Set the vertical vernier reading zero.

6 Take a reading on the start held on B.M (or) reference point.

7 Bisect the object P and read both vernier.

8 Change the face again sight P and read both verniers.

9 Take mean of the four readings, which is correct the value of the vertical angle.

10 Shift the instrument to B and take similar observations as A.

Let

α = the angle of elevation observed at A.

B = the angle of elevation observed at B.

b = the horizontal distance between the adjustment stations A and B.

D = the distance of the object from the near station.

h = height of the object P above instrument axis at 'A'.

h_s = the staff reading at the B.M when the instrument is at A.

h_b = the staff reading at its B.M when the instrument is at B.

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h_d = the level difference between the two position of the instrument axes.

= $h_a = h_s$.

When the instrument at further station B is higher than that at the near station A. (Fig 2)

h= D tan α ----------(i)

h- h_d = (D+b) tan B----------(ii)

putting the value of h from (i) in (ii)

D tan α - h_d = (D+h) tan B=

D tan B + b tan B

(or) D tan α–tan B = b tan B+h_d

or $$D = \frac{b \tan B + h_d}{\tan \propto - \tan B}$$

put this value of D in (i)

$$h = \frac{b \tan B + h_d}{\tan \propto - \tan B} . \tan \propto$$

Height of the object above the B.M.

H= h+hα

When the instrument at further station B is lower than that at near station A. (Fig 3)

Here,

h= D tan α ----------(i)

h+ h_d = (D+b) tan B ----------(ii)

The working as above

$$h = \frac{b \tan B - h_d}{\tan \propto - \tan B} \tan \propto$$

H= h+ hα

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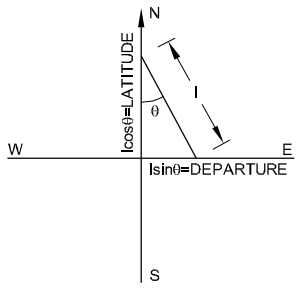
Calculate of departure, latitude, northing and easting

Objective: At the end of this exercise you shall be able to
- **calculate of departure, altitude, northing and easting.**

PROCEDURE

TASK 1: **Calculate of departure latitude northing and easting (Fig 1)**

Fig 1



Take l is the length of line, and 'O' is its reduced bearing.

Then,

i Latitude = l cosθ

Departure = l sin θ

ii $\tan\varphi = \frac{\text{departure}}{\text{latitude}}$

(or)

$\varphi = \tan^{-1}\frac{\text{departure}}{\text{latitude}}$

iii a $l = \sqrt{\text{latitude}^2 + \text{departure}^2}$

b l =latitude x secθ

c l = departure cosceθ

Example

The co-ordinates of two points A and B are given

Point	co-ordinates	
	Northing	Easting
A	500.25	640.75
B	840.78	315.60

Find length and bearing of AB.

Solution

Let l = the length of AB

= the reduced bearing of AB.

Latitude of AB = the difference between the north co-ordinates of A and B = 840.78- 500.25=340.53

Departure of AB = the difference between, the east co-ordinates of A and B = 315.60-640.75=-325.15

$\therefore$ θ = 43° - 41'

Since the latitude is +ve and the departure is -ve.

The line AB lines in the fourth

(N.W.) quadrant.

$$\tan\varphi = \frac{\text{departure}}{\text{latitude}} = \frac{325.15}{340.53} = 0.9548$$

$\therefore$ R.B of AB = N 43°41' W

W.C B of AB = 360° - 43° 41'

= 316° 19'

= 470.83m.

Check length of AB = latitude of

AB x secθ.

= 340.53 x sec 43° 41'

$$\text{Length of AB} = \sqrt{(L)^2 + (D)^2}$$
$$= \sqrt{(340.53)^2 + (325.15)^2}$$

= 470.88m.

Example

Included angle of the triangle PQR (Fig 2) $\angle QPR$ = bearing of PR - Bearing of PQ.

= 37° 6'-18' 36' = 18° 30'

$\angle RQP$ = Bearing of QP = Bearing of QR = 198° 36' - 60° 24' = 138° 12'

$\angle PRQ$ = Bearing of RQ - Bearing of RQ - Bearing of RP. = 240° 24' - 217' 6' = 23° 18'

Check: $\angle P + \angle Q + \angle R = 18°30' + 138°12'$

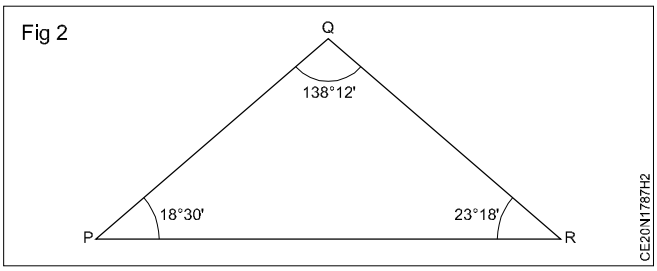
+ 23° 18' = 180° 00'

Length of PQ and QR.

Apply line rule

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Fig 2



$$\frac{PR}{Sin\angle Q}=\frac{PQ}{Sin\angle R}=\frac{QR}{Sin\angle P}$$

$$PR=\frac{PRxSin\angle R}{Sin\angle Q}=\frac{1421xsin23°18'}{sin138°12'}$$

$$=\frac{1421x0.3955}{0.6665}=843.22m$$

$$QR=\frac{PRxsin\angle P}{sin\angle Q}=\frac{1421xsin18°30'}{sin138°12'}$$

$$=\frac{1421x0.3173}{0.6665}=676.49m$$

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Setting out work for building work etc

Objectives: At the end of this exercise you shall be able to
- **setting out work for building**
- **setting our work for culvert**
- **setting out work for centre line of dams**
- **setting out work for bridges**
- **setting out have for slope of earth work.**

Requirements

Tools/Equipments/Instruments

- Theodolite with tripod - 1 No each.
- Plumb bob - 1 No.
- Peg - 1 No.
- Ranging rod - 1 No.

Materials

- White paper - 1 No.
- Pencil - 1 No.
- Eraser - 1 No.

PROCEDURE

TASK 1: **Setting out work for building**

1 Set the theodolite at the site.

2 Instructor should demonstrate construction of proposed building survey.

3 He should emphasize presafety precautions and operational safety precautions to be observed during survey.

4 He should also state post safety precautions to be observed.

5 After his demo of the theodolite at site from the proposed construction of the building traniees should repeat the same.

6 In the same manner by using the theodolite the other objectives of this exercise should be demonstrated by the instructor and the trainees should repeat the same.

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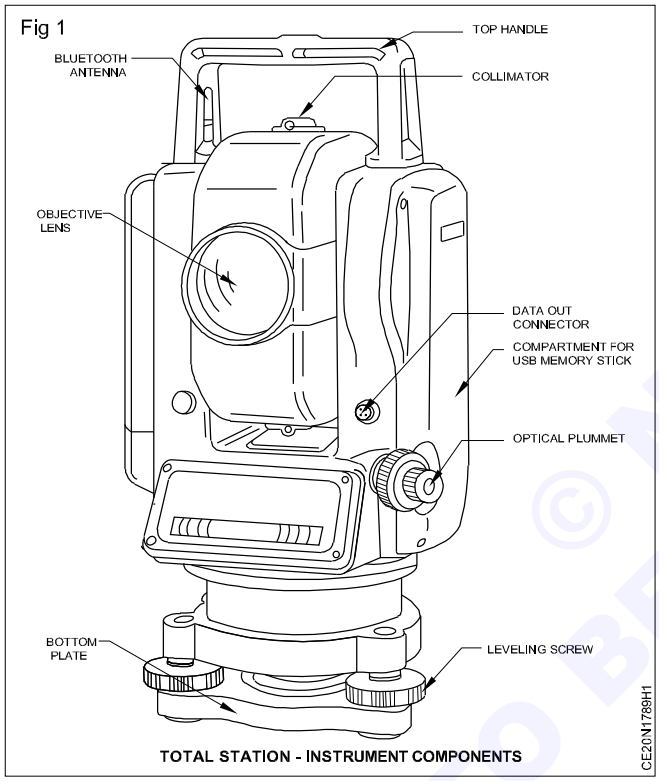
Application of survey using total station

Objectives: At the end of this exercise you shall be able to
- **unplace and place total station from and to the carrying box respectively**
- **fix and unfix total station to and from the tripod respectively**
- **identify parts of the total station**
- **perform levelling and centering of the total station.**

PROCEDURE

TASK 1: **Setting up of total station**

The following steps are followed for the set up of a total station at a station point. (Fig 1)



1 Choose an adequate instrument station. Make sure that an observe can safely operate the instrument with out knocking it over. It is necessary to have the center of the instrument, which is the point of intersection of the transverse axis and the instrument, which is the point of intersection if the transverse axis and the vertical axis if the instrument, directly over a given point on the ground (the instrument station).

2 Remove the plastic cap from the tripod, and leave the instrument is the case until the tripod is nearly level. Stretch the tripod legs 10-15 cm shorter than their maximum length.

3 Open the legs of the tripod to set tripod head at the level of the operator's upper chest. When the total station is set up on the head, the operator's eye should slightly above the eyepiece. The instrument height is important for an effective and comfortable survey. One should not touch or cling to the tripod during the sur vey.

4 At the new station without a reference point on the ground level up the total station at an arbitrary point, where a stake can easily go in and be steady, and put down the stake and the center using the plummet.

5 To occupy an existing a station above a reference point, first roughly develop the tripod head right above the point. For levelling up a small levels is useful. To find out the position, use a plumb bob or drop a stone through the hole in the tripod head.

6 Once roughly levelled and centered push each tip of the period tripod leg firmly into the ground, applying full height of the observer on the step above the tip. Apply the weight along the tripod leg without bending it.

7 Check the level and center it again. Adjust the level by changing the leg length.

8 Fix a tribrach with a plummet, a tribrach and a prism carrier with a plummet or a total station with a built-in plummet on the tripod head.

9 Adjust the three screws of the branch to center the bubble of a spirit level with the following steps:

a Release the lock of the horizontal circle.

b Rotate the instrument to set the plate level parallel to AB at the 1st position.

c Turn the foot screws A and B in the opposite direction, the same amount to center the plate level. This will adjust the tilt on the aa' axis.

d Rotate the instrument 90° to the set the plate level and the 2nd position.

e Turn the foot screw C to the center plate level, adjusting the tilt along CC".

f Rotate the instrument 90^{0} to set plate level in the 3^{rd} position.

g Turn the foot screws A and B in the opposite direction, the same amount to eliminate half the centering error.

h Rotate the instrument 90^{0} to the set the plate level at the 4th position.

i Turn the foot screw C to eliminate half the centering error.

j Repeat b to i until the plate level is centered in all directions (give a little time for slow movement of the bubble in viscous fluid).

10 Pull out of the optical plummet and use the optic ring to focus the graduation and then focus at the mark on the ground or turn on the laser plummet. Rotate the plummet or the total station to check, it is centered within 1cm from the reference point. If not, estimate the amount of offset and carefully translate the entire tripod as much as the offset. Return to 4 and try to level and center again. The total station on the tripod head can be translated 1cm from the center, therefore rough centering within 1cm is necessary. Be careful to see that the center of the optical plummet or the laser point is on an axis perpendicular to the horizontal circle of the total station. If the total station is not level, the plummet line does not coincide with the plumb line.

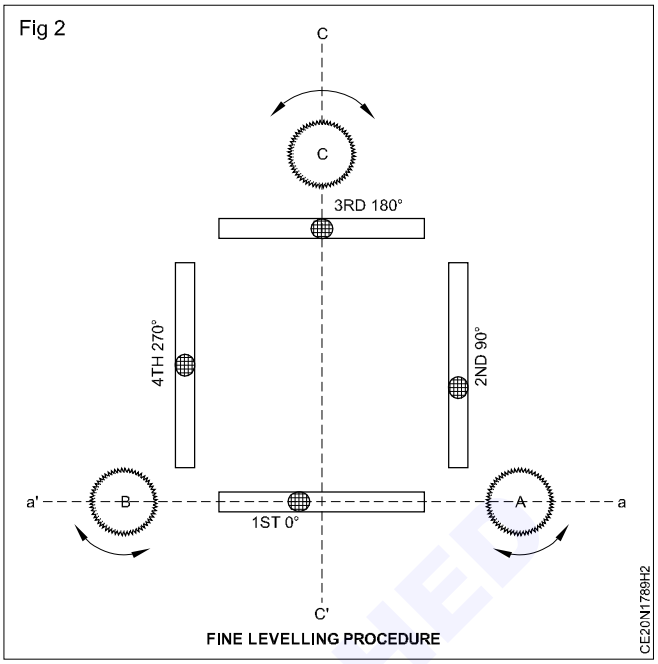
11 Put the total station in the branch if it is not there.

12 Use the plate level for the final levelling of the total station. Follow the instruction given in Fig 2.

13 When the total station is finely levelled up. Use the plummet to check centering. If plummet point out of centre of the reference. Slightly loosen the fixing screw below the tripod head and translate the tribrach to place the plummet center on the exact point. Do not rotate. When the translation is done, tighten the fixing screw moderately. If any portion of the base of the tribrach goes outside the tripod head, return to 4.

14 Rotate the total station by 180° if the plummet center goes away from the point, slightly loosen the fixing screw and slide the total station halfway to the center.

Fig 2



FINE LEVELLING PROCEDURE

15 Repeat the steps 12 and 13 until the plummet center stays exactly on the center of the mark.

16 Tighten the fixing screw firmly without applying too much pressure. Never loosen the screw until all the measurements are finished.

17 Measure the instrument height. The centre of the total station is marked on the side of the alidade. The vertical distance between the mark and the ground is the instrument height.

18 Check the plate level from time to time during measurement before the total station tilts beyond the automatic correction.

— — — — — — — —

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Field procedure for co-ordinate measurement

Objectives: At the end of this exercise you shall be able to
- **reset model space limit**
- **draw the given line diagram using absolute co-ordinate method**
- **draw the given figure-using relative co-ordinate method**
- **draw the given figure-using polar co-ordinate method.**

PROCEDURE

TASK 1: **To draw a line diagram using absolute coordinate method, follow the steps mentioned below**

1 Command: **LIMITS (↵)**

Reset model space limits:

Specify lower left corner or [ON/OFF]

<0.0000,0.0000> : (↵)

Specify upper left corner <12.0000,9.0000>:120,90 (↵)

2 Command: **ZOOM (↵)**

Specify corner of window, enter a scale factor (nx or nxP), or [All/Center/Dynamic/Extents/Previous/Scale/ Window] <real time>: All (↵)

Regenerating model space limits:

3 Command : **LINE** (↵)

Specify first point **20,20** (↵)

Specify first point or [Undo] : **100,20** (↵)

Specify next point or [Undo] : **100,50** (↵)

Specify next point or [Close/Undo] : **90,50 (↵)**

Specify next point or [close/Undo] : **86,65 (↵)**

Specify next point or [Close/Undo] : **75,65 (↵)**

Specify next point or [Close/Undo] : **70,50 (↵)**

Specify next point or [Close/Undo] : **50,50 (↵)**

Specify next point or [Close/Undo] : **30,65 (↵)**

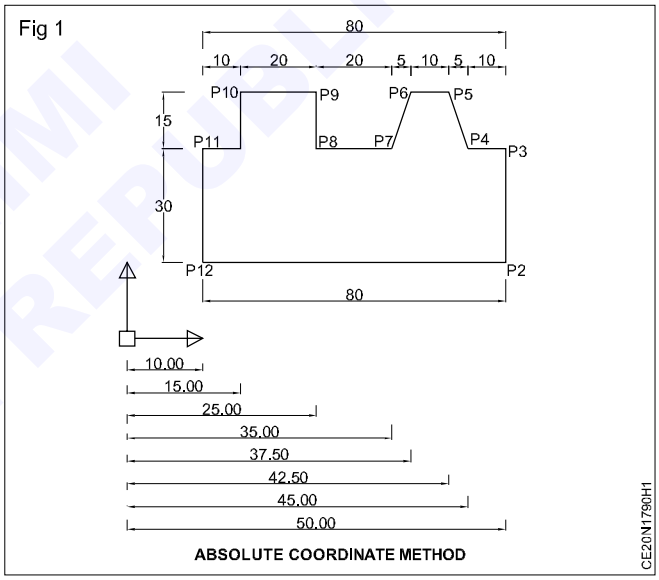
Specify next point or [Close/Undo] : **30,50(↵)**

Specify next point or [Close/Undo] : **20,50(↵)**

Specify next point or [Close/Undo] : **C (↵)**

4 Save this file.

Output (Fig 1)



TASK 2 : **To draw a line diagram using relative coordinate method, follow the steps mentioned below**

1 Command : **LIMITS (↵)**

Reset model space limits:

Specify lower left corner or [ON/OFF] 0.0000,0.0000> : **(↵)**

Specify upper right corner <12,0000,9,0000> : 120,90 **(↵)**

2 Command : **ZOOM**

Specify corner of window, enter a scale factor (nX or nXP), or [All/Center/Dynamic/Extents/Previous/ Scale/ Window] <real time?: **All (↵)** regenerating model.

3 Command : **LINE (↵)**

Specify first point : **20,20 (↵)**

Specify next point or [Undo] :@ **80,0 (↵)**

Specify next point or [Unod] :@ **0,30 (↵)**

Specify next point or [Close/Undo] : @ : **-10,0 (↵)**

Specify next point or [Close/Undo] : @ **-5,15 (↵)**

Specify next point or [Close/Undo] : @ **-10,0 (↵)**

Specify next point or [Close/Undo] : @**-5,15 (↵)**

Specify next point or [Close/Undo] : @ **-20,0 (↵)**

Specify next point or [Close/Undo] : @ **0,15 (↵)**

Specify next point or [Close/Undo] : @ **-20,0 (↵)**

Specify next point or Close/Undo : @ 0,-15

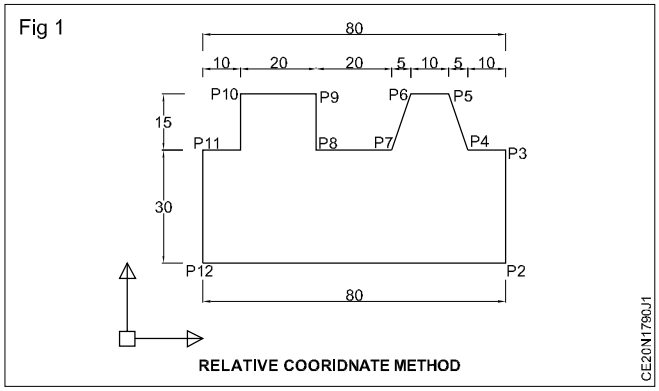
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Specify next point or Close/Undo : @ -10,0

Specify next point or Close/Undo : C

4 Save this file

Output (Fig 1)



— — — — — — — —

TASK 3 : **To draw a line diagram using polar coordinate method, follow the steps mentioned below**

1 Command : **LIMITS (↵)**

Reset model space limits:

Specify lower left corner or [ON/OFF] <0.0000,0.0000>: **(↵)**

Specify upper right corner <12.0000,9.0000>:**120,90 (↵)**

2 Command : **ZOOM (↵)**

Specify corner of window, enter a scale factor (nX or nXP), or All/Center/Dynamic/Extents/Previous/ Scales/Window <real time?: All (↵) regenerating model.

3 Command : LINE (↵)

Specify first point : 20,20 (↵)

Specify next point or Undo : @ 80<0 (↵)

Specify next point or Undo :@ 30<90 (↵)

Specify next point or close/Undo : @ :10<180 (↵)

Specify next point or Close/Undo : @ 15<108 (↵)

Specify next point or Close/Undo : @ 10<180 (↵)

Specify next point or Close/Undo : @ 15<252 (↵)

Specify next point or Close/Undo : @ 20<180 (↵)

Specify next point or Close/Undo : @ 14.27<90 (↵)

Specify next point or Close/Undo : @ 20<180 (↵)

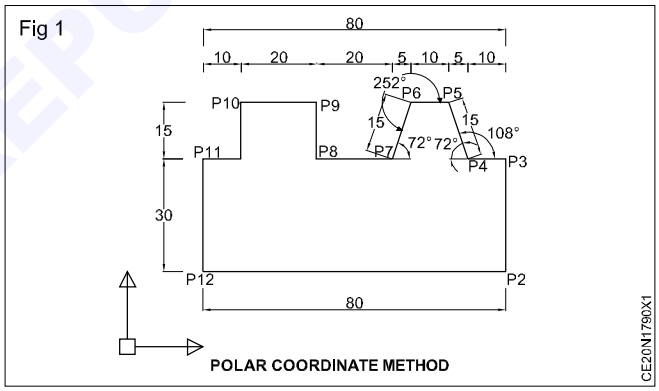
Specify next point or Close/Undo : @ 4.27<270 (↵)

Specify next point or Close/Undo : @ 10.73<180 (↵)

Specify next point or Close/Undo : C

4 Save this file

Output (Fig 1)



— — — — — — — —

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Field procedure to run open traverse and closed traverse

Objectives: At the end of this exercise you shall be able to
- **measure the angles between the traverse lines and included angles**
- **plot the open traverse, closed traverse using co-ordinates**
- **check the traverse.**

PROCEDURE

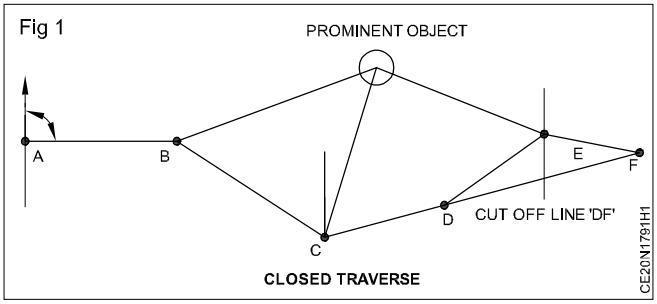
TASK 1: **Open traverse**

1 Reconnaissance the area to be surveyed.

2 Select station as per field conditions.

3 Mark the stations. (Fig 1)

Fig 1



CLOSED TRAVERSE

4 Take at least three permanent reference points of the stations.

5 Set up the instrument at the starting station, say ‘A’.

6 Perform all the temporary adjustments.

7 Measure the magnetic meridian of the line AB using theodolite if it is fitted with magnetic compass (otherwise use prismatic compass).

8 Shift and set up the instrument at station ‘B’

9 Set the vernier scale A, 0-0.

10 Perform all the temporary adjustments.

11 Loosen the lower clamp; direct the telescope towards station A.

12 Tighten lower clamp and bisect the station exactly using the lower tangent screw.

13 Exactly bisect forward station C and observe the horizontal angle (direct angle or deflection angle as described earlier) and record the angle.

14 Thus following appropriate steps observe a face right reading at B. Observe a face left reading as per the traversing method (accuracy can be improved by adopting repetition method).

15 Set up the instrument at forward station ‘C’.

16 Similarly proceed further and finish off the traverse (measured and record directions and distances).

17 Cut off lines and bearings of a prominent object from several stations are also note down for checking the traverse. Details can also locate by any method.

18 Plot the traverse to a suitable scale.

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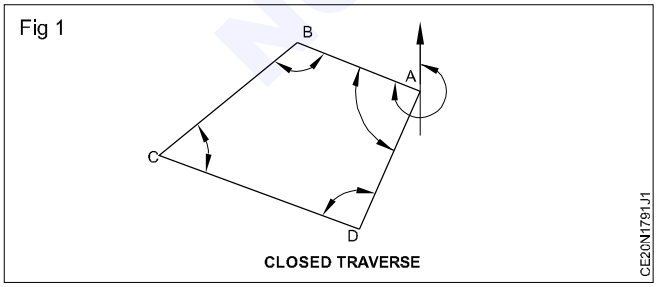
TASK 2: **Close traverse**

1 Reconnaissance the area to be surveyed.

2 Select stations as per field conditions

3 Mark the stations (Fig 1)

Fig 1



CLOSED TRAVERSE

4 Take at least three permanent reference points of the stations.

5 Set up the instrument at the starting station, say ‘A’.

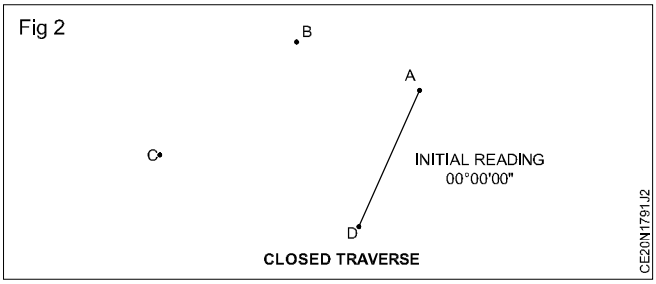
6 Set the vernier scale A, 0-0

7 Perform all the temporary adjustments.

8 Measure the magnetic meridian of the line AB using theodolite it is fitted with magnetic compass (otherwise use prismatic compass).

9 Loosen the lower clamp; direct the telescope towards the last back sight station D. (Fig 2)

Fig 2



CLOSED TRAVERSE

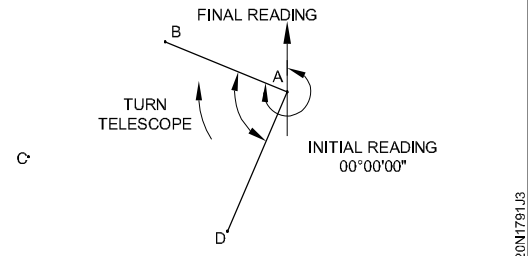
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10 Tighten lower clamp and bisect the station exactly using the lower tangent screw.

11 Loosen upper clamp; telescope is turned to sight the forward station ‘B’

12 Tighten upper clamp. Bisect ‘B’ exactly and observe the horizontal angle. (Fig 3)

Fig 3



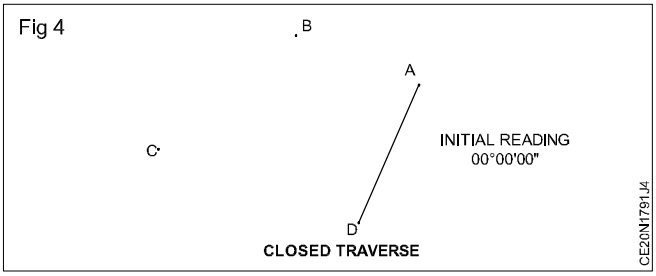
FACE LEFT OBSERVATION CLOSED TRAVERSE

13 Following appropriate above steps observe a face right reading (accuracy can be improved by adopting repetition method). (Fig 4 & 5)

14 Measure horizontal angles by both face observation at each station.

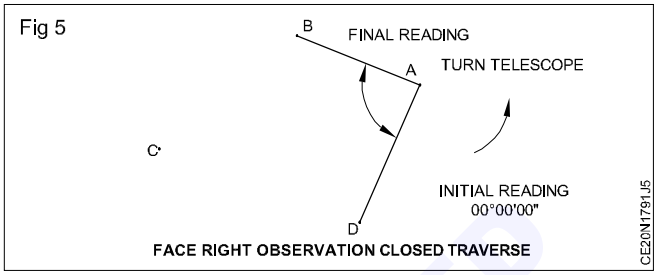
15 Measure the length of the side.

Fig 4



CLOSED TRAVERSE

Fig 5



FACE RIGHT OBSERVATION CLOSED TRAVERSE

16 Proceed thus to finish off the traverse.

17 Calculate the coordinates.

18 Arithmetically balance the traverse if error exists.

19 Plot the traverse using coordinates.

20 Balance the traverse graphically if traverse failed to close while plotting.

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Open traverse

Instrument At	Sight to	Length (m)	Face left / Right swing									Face right / Left swing										Horizontal Angle			Average / Remarks	Rough Sketch
			A			B		Mean			No. of repetitions	Horizontal angle			A			B		Mean			No.of Repititions	Horizontal Angle				
			0	‘	“	‘	“	0	‘	“		0	‘	“	0	‘	“	‘	“	0	‘	“		0	‘	“	0	‘	“		
P	Q																													Bearing of PQ=	

Close traverse

Instrument At	Sight to	Length (m)	Face left / Right swing									Face right / Left swing										Horizontal Angle			Average / Remarks	Rough Sketch
			A			B		Mean			No. of repetitions	Horizontal angle			A			B		Mean			No.of Repititions	Horizontal Angle				
			0	‘	“	‘	“	0	‘	“		0	‘	“	0	‘	“	‘	“	0	‘	“		0	‘	“	0	‘	“		
P	Q																													Bearing of PQ=	

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Establishment of bench mark

Objective: At the end of this exercise you shall be able to
- **set out/state out the known coordinate in the field using total station.**

Requirements

Tools/Equipments/Instruments

- Total station in carrying box with tripod, prism and reflector pole.

PROCEDURE

1 Establish the total station. Do the centering and levelling. Do the station set up.

2 In main menu, bring the cursor in program and press enter key. (Fig 1 & 2)

Fig 1

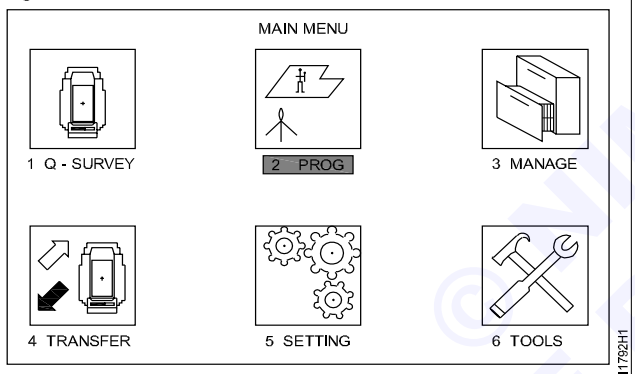
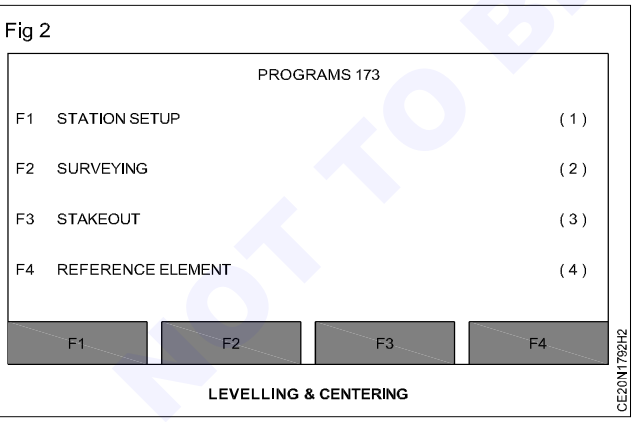


Fig 2



3 Press F3. (Fig 3)

4 Press F1 set job. (Fig 4)

5 Press F1 new and give job name or choose the job from memory and press F1 ok. (Fig 5)

6 Press F4 ok. (Fig 6)

Fig 3

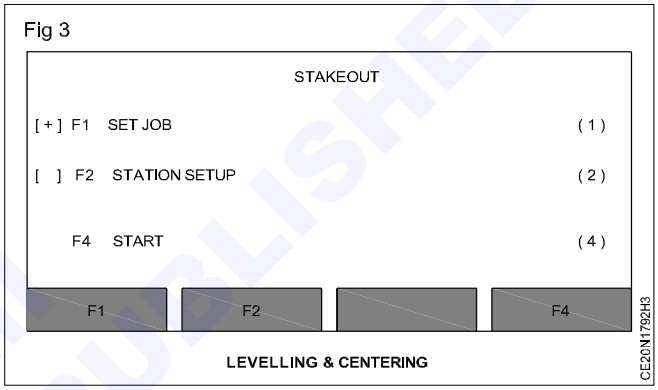
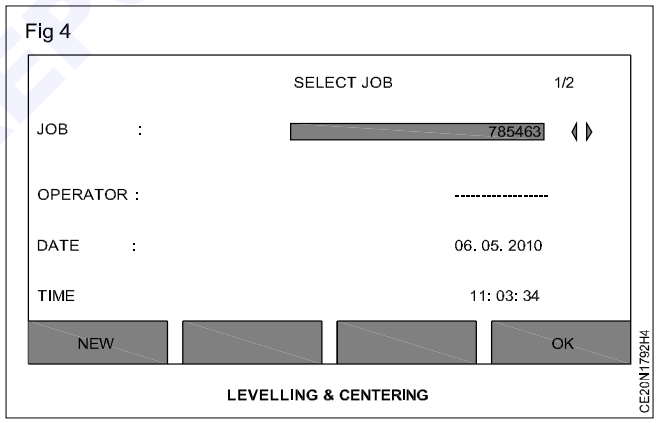


Fig 4



7 If your station setup is already done then press F4 start. (Fig 7)

8 After that select the point ID from memory. It will indicate angle and distance. Make the angle zero with the help of slow key.

9 Mark the new points press F4 arrow key until ENH appears. (Fig 8)

10 Press F2 (ENH). (Fig 9)

11 Give the pt ID and give the Easting, Northing and Height and press F4 Ok. (Fig 10.11)

12 Now it is same as before.

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Fig 5

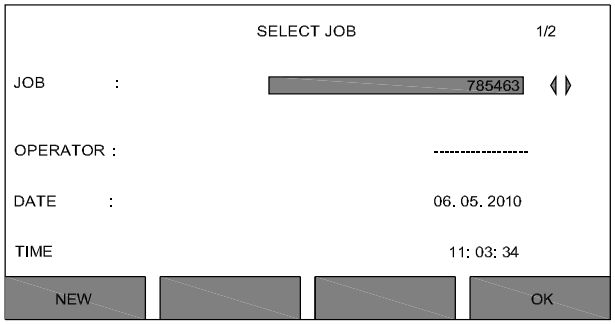


Fig 6

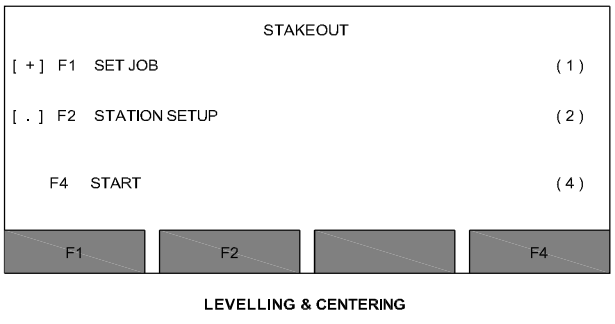


Fig 7

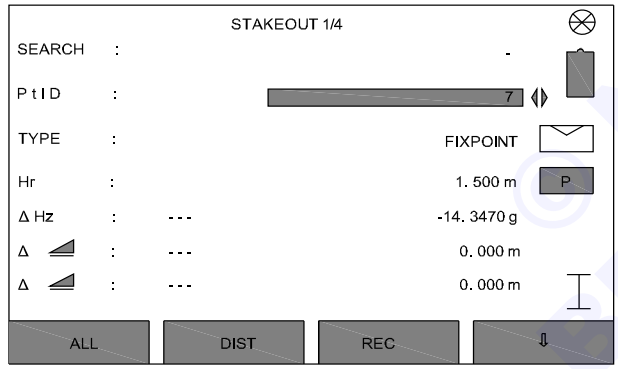


Fig 8

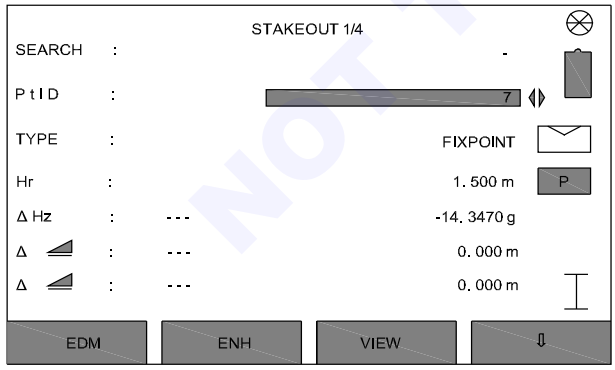


Fig 9

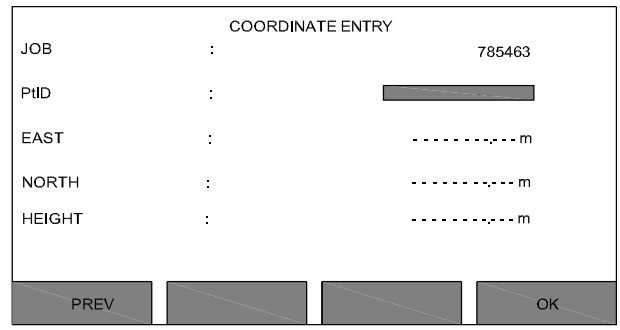


Fig 10

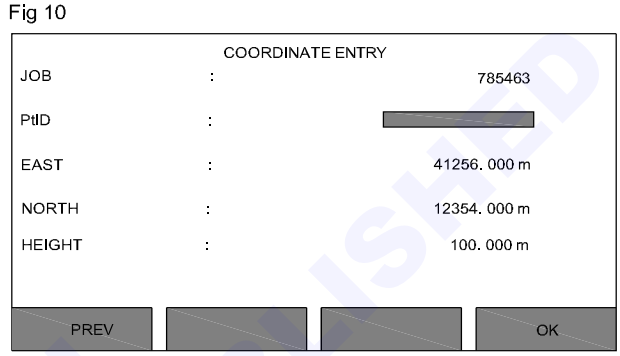
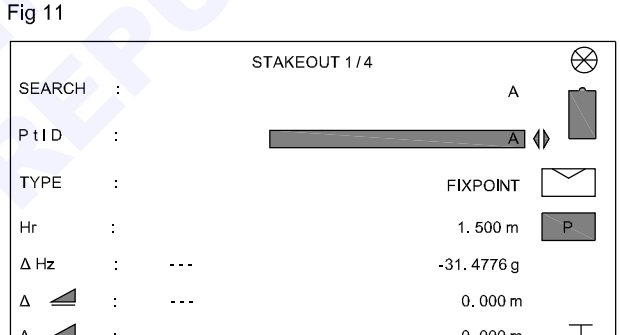


Fig 11



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Perform stake out / demarcation of building layout /plot layout/ roads/ alignment

Objective: At the end of this exercise you shall be able to
- **identify the different stake out performance.**

PROCEDURE

TASK 1: **Identifying different stakeout performance (Fig 1- 18)**

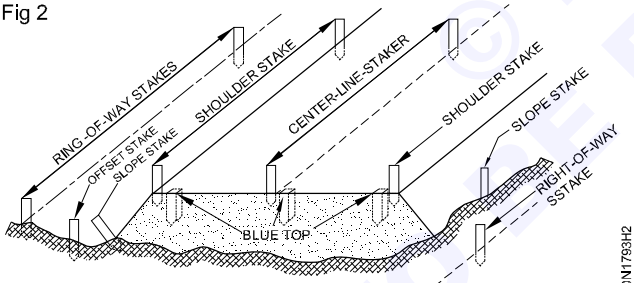
Instructor shall display and demarcation to the students, regarding the stake out performance and building layout, plot layout, roads and alignment.

Fig 1



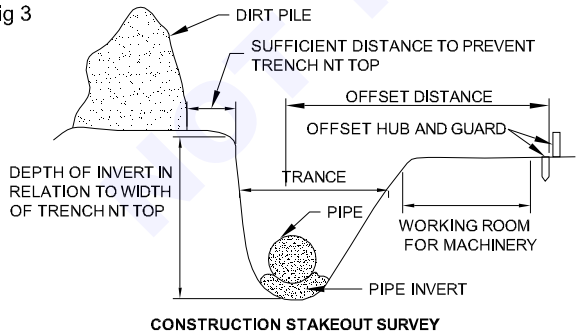
Stakeout Total Station

Fig 2



STAKEOUT SURVEY

Fig 3



CONSTRUCTION STAKEOUT SURVEY

Fig 4



Fig 5



Fig 6



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Fig 7

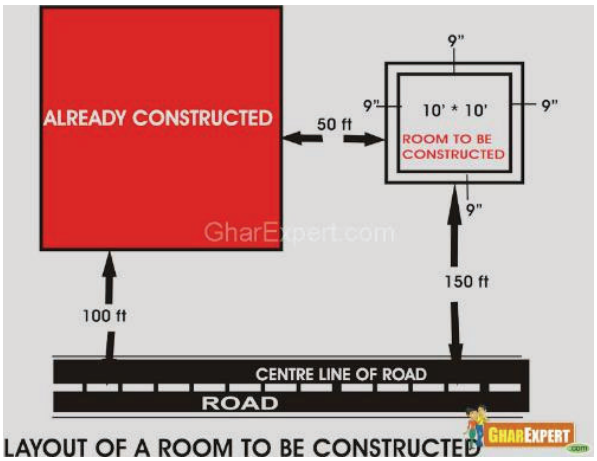


Fig 8

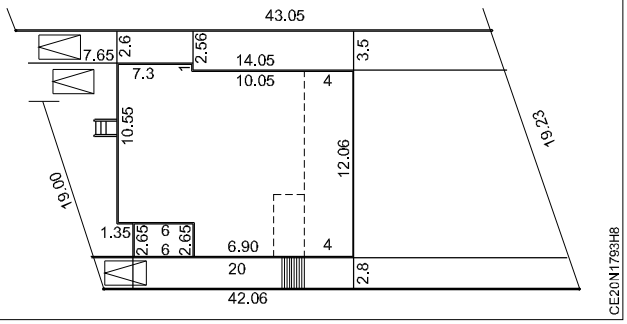


Fig 9

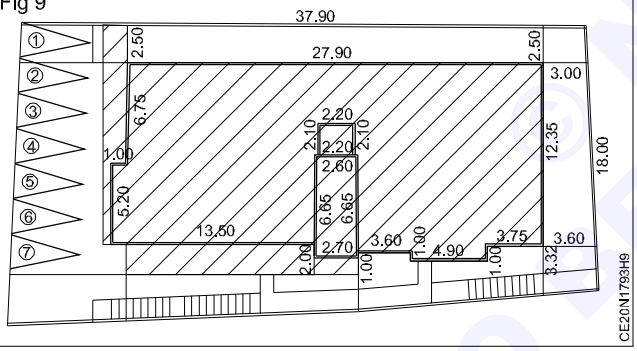


Fig 10

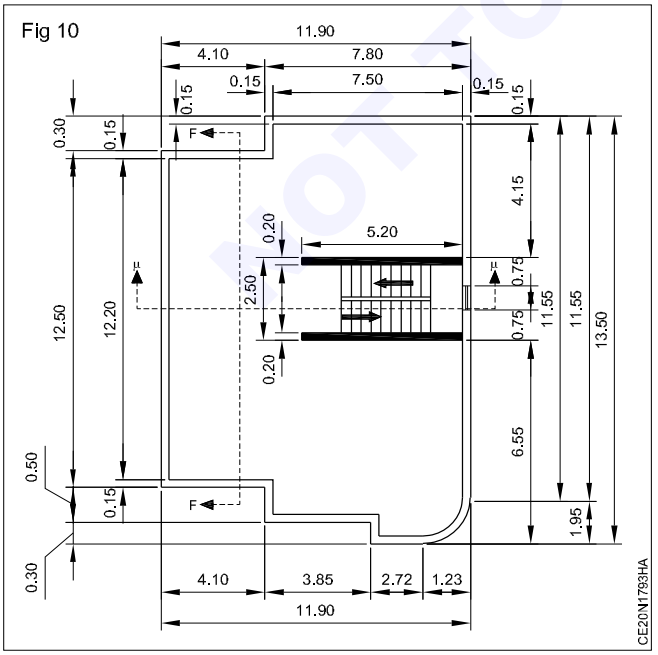


Fig 11



Fig 12



Fig 13



Fig 15



Fig 17



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Fig 14

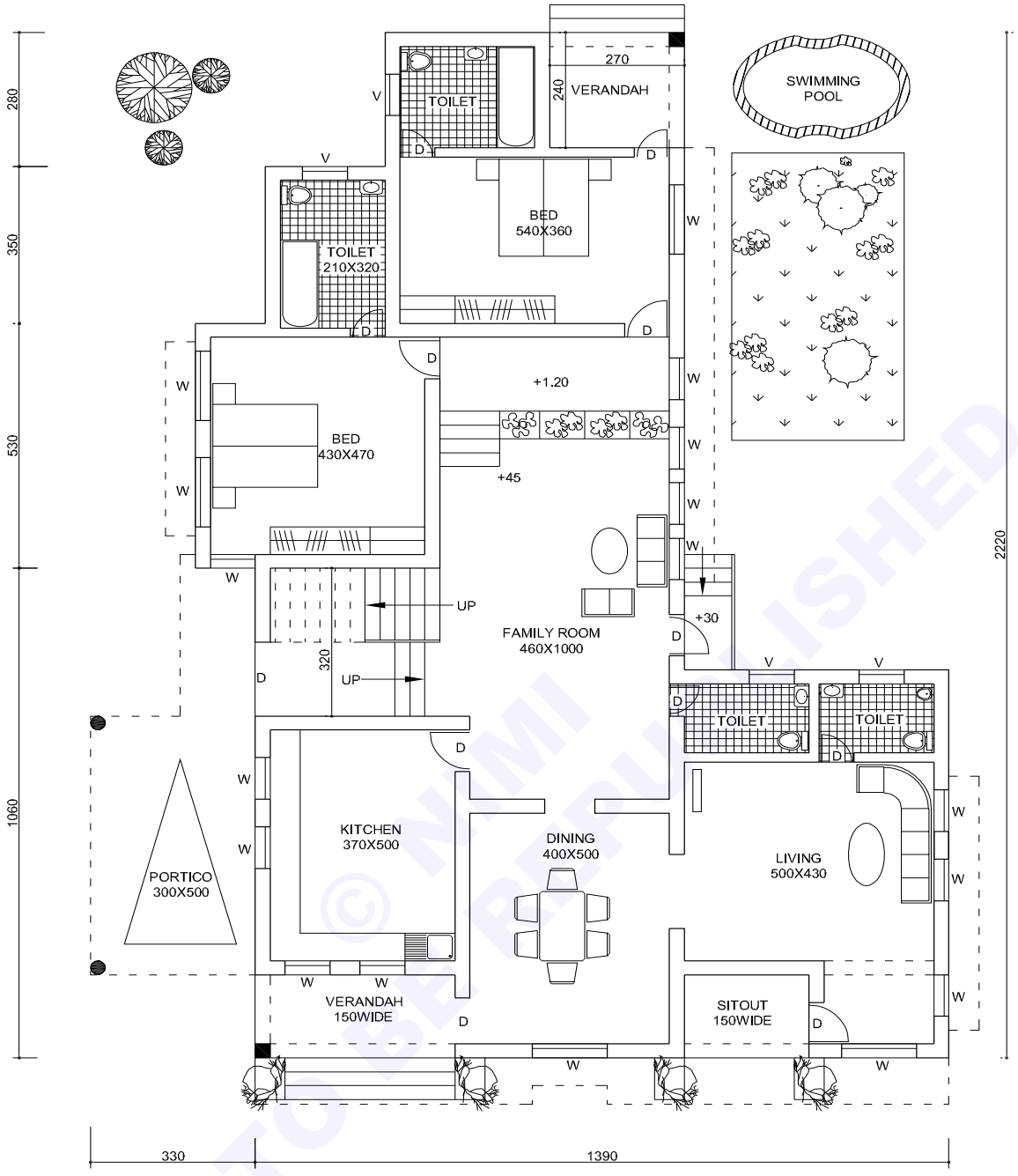
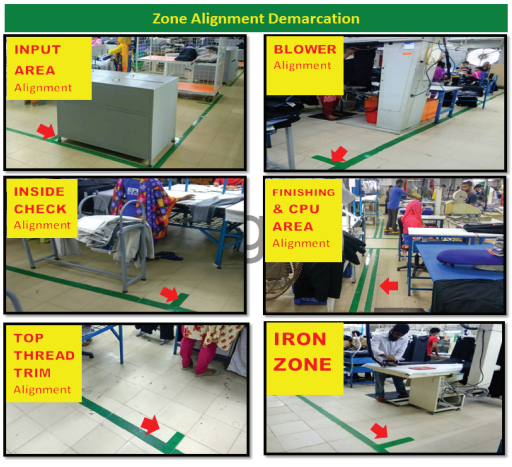


Fig 16



Fig 18



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Measure remote distance and elevation

Objective: At the end of this exercise you shall be able to
- **compute the distance bearing and grade between two points using a total station.**

PROCEDURE

TASK 1: **Measuring distance**

1 Establish the total station. Do the centering and levelling. Do the station setup. The tie distance program is used to find the horizontal distance between two points either by measurement in the field or if the coordinates of the points present in the memory.

- Press MENU.
- PRESS F1 (Program) (Fig 1)
- Press PAGE. (Fig 2)

Fig 1

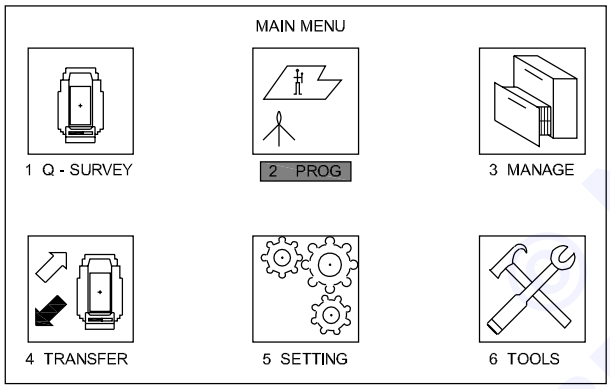
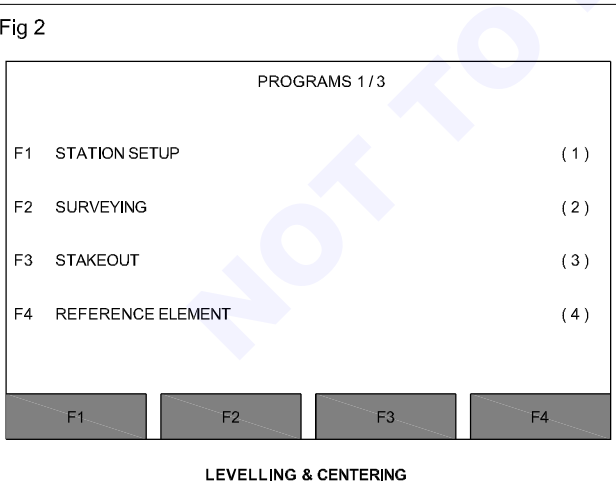


Fig 2



- Press F3 (remote height). (Fig 3 & 4)
- Now put the prism on the base point and sight it and press F3 (ALL) (Fig 5).
- Now move the telescope and focus the top point whose elevation is to be found.

Fig 3

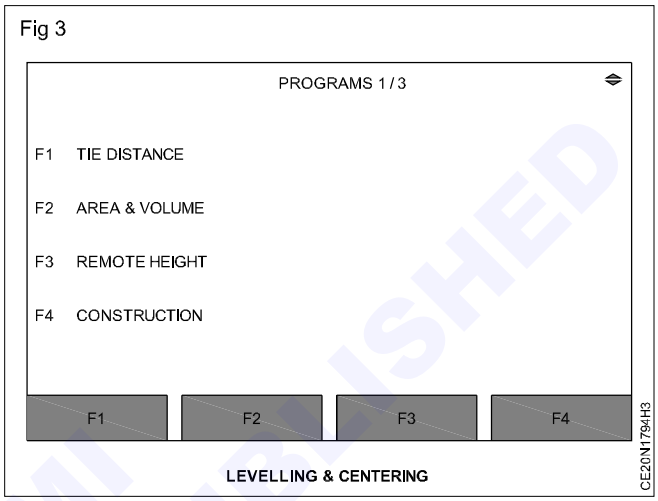


Fig 4

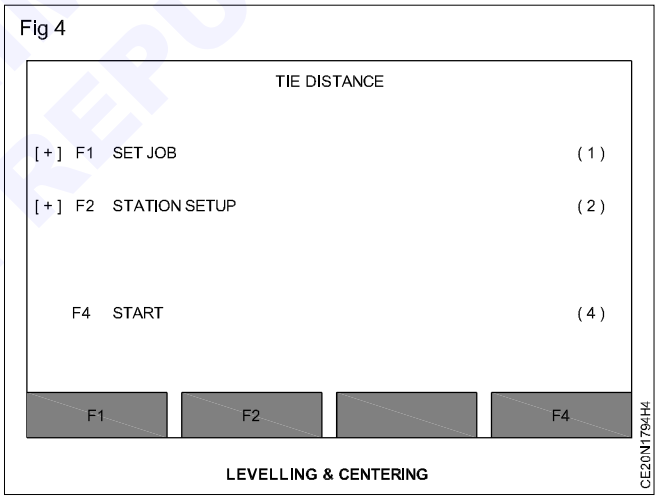
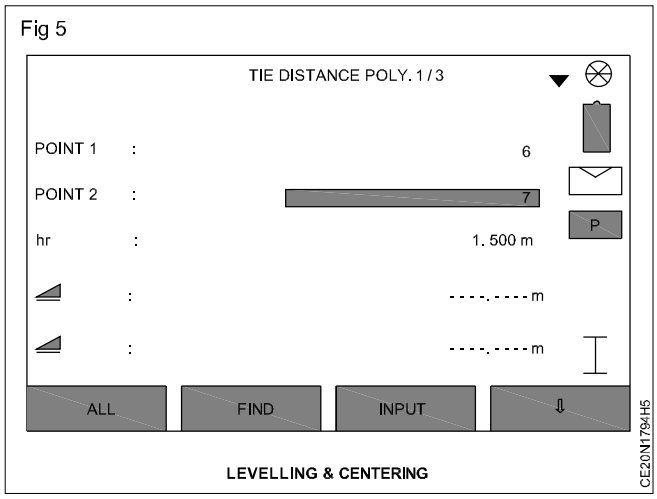


Fig 5



- The height value will be displayed on the screen.

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Calculate surface area and volume on field/site

Objective: At the end of this exercise you shall be able to
- **compute the area of a plot in the field itself using a total station.**

PROCEDURE

TASK 1: **Computing area of a plot**

1 Establish the total station. Do the centering and levelling. Do the station set up.
- Press MENU.
- Press F1 (Programs). (Fig 1)
- Press PAGE. (Fig 2)
- Press F2 (Area). (Fig 3)

Fig 1

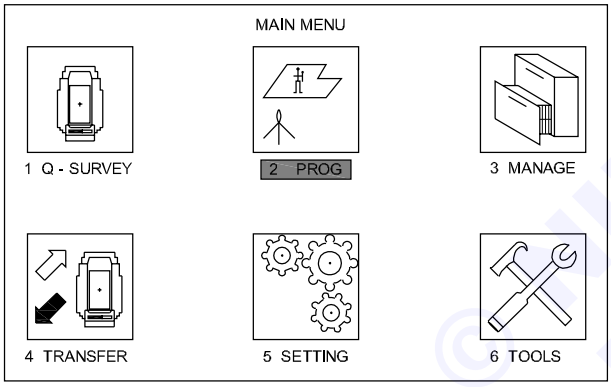
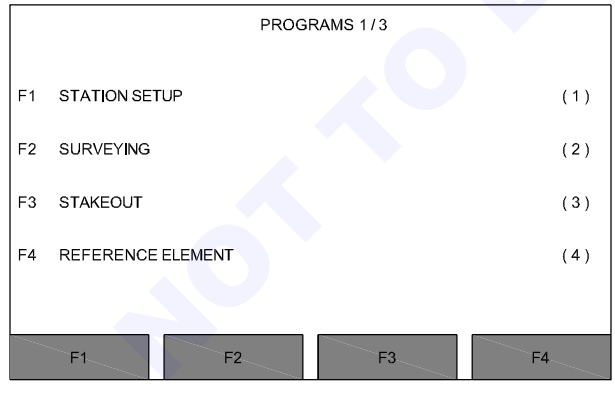


Fig 2



- The first three steps are the same.
- Press F4 (Start). (Fig 4)
- The points whose area is to be found can be either in the memory or cab ne slot directly in the field.
- In front of point ID enter the number of the first point press F3 (All). (Fig 5)

Fig 3

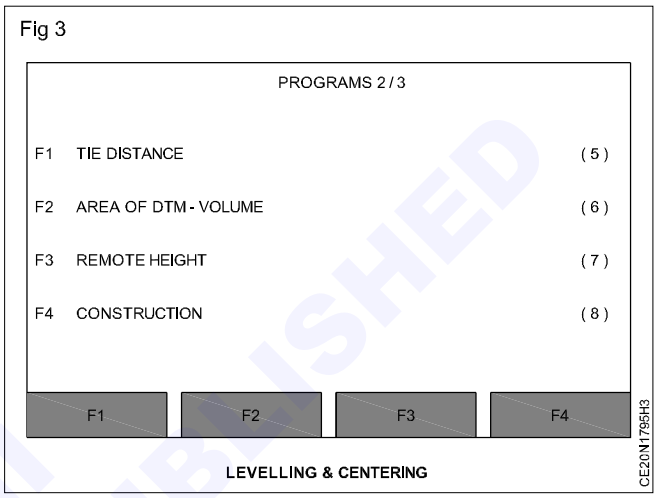


Fig 4

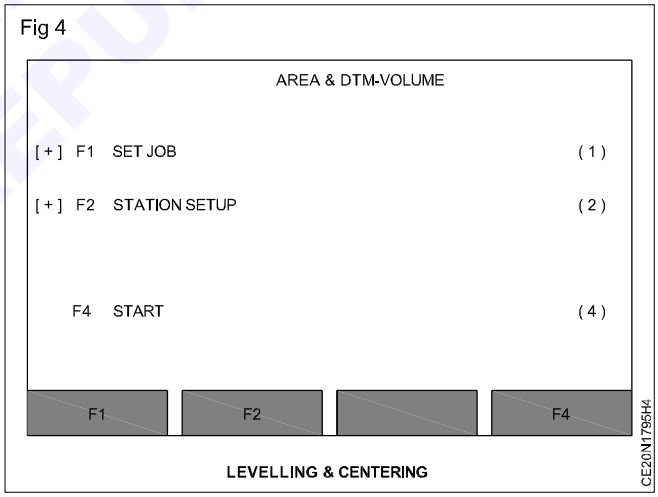
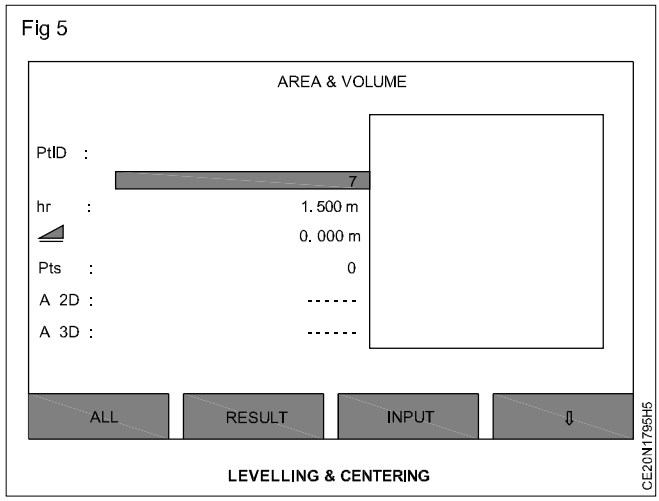


Fig 5



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Procedure for down load and up load data

Objective: At the end of this exercise you shall be able to
- **procedure for uploading the data**
- **procedure for downloading the data.**

PROCEDURE

TASK 1: **Procedure for uploading the data**

1 Uploading data is being sent from your computer to the internet

- Examples of uploading include sending email, posting photos on a social media site and using your webcam.
- Even clicking on a link on a web page sends a tiny data upload.

— — — — — — — —

TASK 2: **Procedure for downloading the data**

1 Downloading in your computer is receiving data from the internet

- Examples of downloading include opening a web page, receiving email, purchasing music files and watching online videos.

Introduction

- In order provide your application with cool pictures, you can employ two techniques (at least). One of them is that you can save the pictures in a folder and store the path to each one in a database or file. The other one is to store the entire file into a database, along with its file name.

Each of them has its ups and downs

- If you save your files to a folder, you might accidentally delete a file from that folder. If this happens, you will end up with a broken “link” in your database or configuration file. However, the hard disk storage space is cheap, so you can afford to store a lot of file.
- If you store your files into database, you can enforce security by using the security settings of the database. Also, there are no broken links ever. However, the database storage space is more expensive.
- Another idea is that you can save a thumbnail of the image on the database for quick access and save the actual picture on hard drive.
- Each application has its particulars, and you have to choose which one you will use.
- Ok Enough of the philosophical talk! Let’s dive into the good stuff.

The application

- The problem of uploading files to a database is not that difficult. You have to use, on the server. a certain data type when creating the table. This data type has to be capable of storing large amounts of binary data.
- When using Microsoft SQL server, this data type is called image.
- For more information see BLOB (Binary Large Object) for a short definition, and books online for a complete reference.
- The client has to obtain the data from the file in binary format-a byte array-and call a procedure on the server with that array as a parameter.

The SQL server procedures

- In this presentation, I assume that I have a database pictures on the server with a table called pictures. The structure of this table is as follows:

Field Name	Field Type
File Name	Long
picture	Image
File Name	Varchar (25∅)

- I also have stored procedures for uploading, and retrieving the list of uploading files. These are shown below.
- “Uploading” and “downloading” are terms used to refer to types of electronic data transfers. The difference between them is the direction in which the files are being transferred.
- Files are considered to be uploaded when they are transferred from a computer or other electronic device to a central server, and downloading is when the files are transferred from a server to a smaller peripheral unit, such as a computer, smartphone or other device.
- These two different types of transfers are often done via the internet, such when a file is downloaded from a website. The transfer of data from one system or device to a similar system or device, such as from a desktop computer to a laptop, usually is not considered uploading or downloading.

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Uploading

- The most common type of uploading is when a user uploads a digital file to an internet site. For example, a user might upload vacation photos to a social networking website or home video to a video sharing site. The uploaded files are then stored on the website's servers and can be seen by anyone who has internet access and, if necessary, the right software for viewing it.
- Other website allow users to upload digital files for storage. This can allow users to store more files or larger files than would be possible to store on their own computer or device because of its limited storage capacity. Uploading files to storage websites also allows users or other devices to have access to them. Permission to access to files can be granted to only certain people, or the files could be made public for anyone to access.
- Another type of uploading takes place within a closed computer system, such as one within a single office building or one that connects a group of businesses. These types of systems typically have servers to store information that needs to be shared among multiple computers or devices. Digital files can be uploaded from any computer or device that is connected to the system, then can be downloaded or accessed by any other user in the system.

Downloading

- Whenever electronic files or information are transferred from a central system to a computer or device that is connected to that system, it is considered downloading. Files can be downloaded temporarily and then deleted after they have been used once, or they can be downloaded on a more permanent basis and used for a long period of time. For example, a funny video file might be downloaded from the internet and soon deleted after it has been watched, but a helpful application might be downloaded and used for months or years.
- Downloaded files are sometimes automatically stored in a particular location on the computer or device and they are automatically accessed from that location when needed. An example of this is an application that is downloaded to a smartphone - user typically cannot control where the app is stored on the phone, it is simply stored where the phone stores all of its apps. In other cases, the user can choose where the downloaded files will be stored. For example, a laptop user might download a music file to a specific folder for music or another type of file to the computer's desktop, where it can be found quickly.

Speed

- The time that it takes to upload or download a file depends on several factors. The main factor is the digital size of the file, which is measured in bytes. The larger the file, the longer it takes to transfer the information in it.
- The quality of the connection from the internet or central server to the smaller computer or device also makes a difference in the transfer speed. A computer that has high-speed internet connection will be able to download or upload a file much more quickly than a computer that has a low-speed connection would. In addition, the speed of the server on which the file is stored can affect upload times or download times.

Background operations

- Uploading and downloading occur frequently, often without the user being aware that he or she is doing it. For example, incoming email is downloaded from a server, and outgoing emails are uploaded to be sent out. The source code of a web page is downloaded to the user's computer so that he or she can view the content. Whenever a computer or device is connected to the internet or another larger system, files are frequently transferred back and forth-uploaded and downloaded-throughout the normal course of use.

Uploading

- Word of the day

colocation (colo)

- A colocation (colo) is a data center facility in which a business can rent space for servers and other computing hardware. Typically, a colo provides the building. cooling. power, bandwidth and physical security while the customer provides servers and storage.
- Subscribe to the word of the day
- Word of the Day Archive

Newest and uploaded Terms

- artificial superintelligence (ASI)
- technology addiction (Internet addiction)
- orbi outdoor satellite
- competitive advantage
- mobile application management (MAM)
- Avro (Apache Avro)
- quality assurance (QA)
- gross revenue
- voice recognition (speaker recognition)
- Amazon Pinpoint
- employee engagement software
- Microsoft Project Honolulu
- project scope
- unstructured data
- hands-off infrastructure management
- Microsoft Windows Insider Program for Business
- cloud ecosystem

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- risk map (risk heat map)
- VMware VCenter Server (formerly VMware Virtual Center)
- Advanced message Queuing Protocol (AMQP)
- Uploading is the transmission of a file from one computer system to another, usually larger computer system. From a network user's point-of-view, to upload a file is to send it to another computer that is set up to receive it. People who share images with others on bulletin board services (BBS) upload files to the BBS.
- Transmission in the other direction is downloading from one, usually larger computer to another, usually smaller computer. From an internet user's point-of-view, downloading is receiving a file from another computer.
- The file Transfer Protocol (FTP) is the internet facility for downloading and uploading files. (If you are uploading a file to another site, you must usually have permission in advance to access the site and the directory where the file is to be placed).
- When you send or receive an attached file with an e-mail note, this is just an attachment, not a download or an upload. However, in practice, many people use "upload" to mean "send" and "download" to mean receive. The term is used loosely in practice and if someone says to you "Download (or upload) such-and-such a file to me" via e-mail, they simply mean "Send it to me."
- In short, from the ordinary workstation or small computer user's point-of-view, to upload is to send a file and to download us to receive a file.

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Simple survey map using Auto CAD

Objective: At the end of this exercise you shall be able to
- **prepare a map of a village using auto cad.**

PROCEDURE

TASK 1: **Prepare a map of a village (Open traverse)**

1 Select the instrument stations A,B&C etc., after inspecting the site to get rough idea about the village. (Fig 1 showing a typical village)

2 Set up the table 'A' Select the point a suitably on the sheet.

3 Centre and level the table when the board is clamped.

4 Mark the direction of the magnetic north on the sheet.

5 Place a ranging rod on station 'B'.

6 Keep the alidade on 'a' sight the ranging rod at 'B'.

7 Draw a ray along the beveled edge of alidade.

8 Measure the distance AB with tape.

9 Select suitable scale and set off distance 'ab' on the ray already drawn.

10 Locate the surrounding details by radiation or intersection.

11 Shift the instrument and set it up at 'B'.

12 Centre and level the Table.

13 Orient the table by back sighting on 'A'.

14 Clamp the table.

15 Place the ranging rod on station 'C'.

16 Keep the alidade pivoted on 'b' sight the station 'C'.

17 Draw a ray along the fiducial edge of the alidade.

18 Measure the distance 'BC' with tape.

19 Set off distance 'bc' on the ray.

20 Locate the surrounding details by radiation or intersection.

21 Proceed the same process until all the remaining stations and surrounding details are to be plotted.

22 Prepare the map drawing using CAD software.

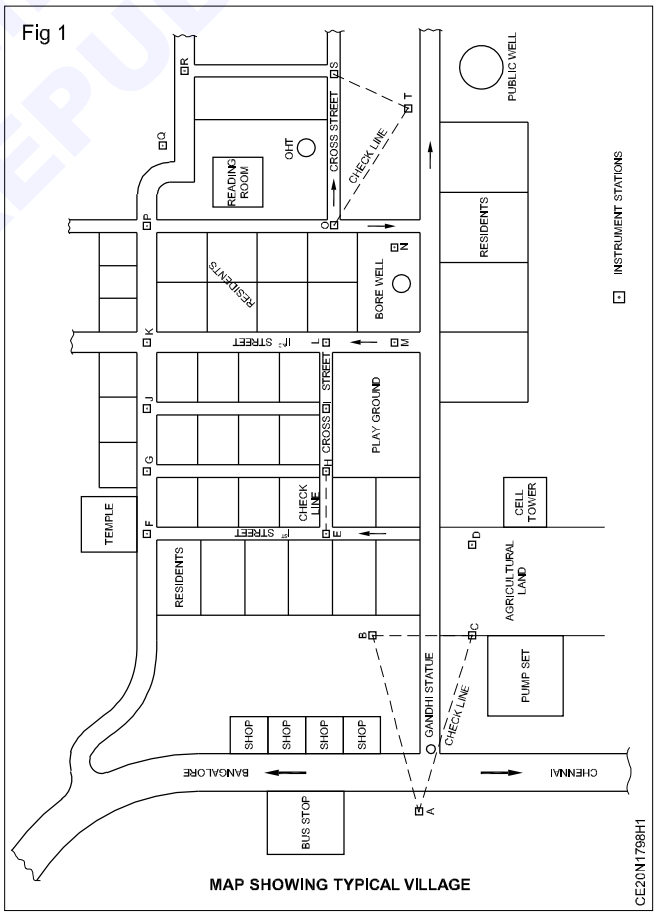
At any station, the work can be checked by taking sights to two or more preceding stations visible from the station occupied

When no station is visible any well defined points or objects such as corner of building electric posts etc may be used for checking.

Radiation is applicable when the distance between the object and instrument station can be measured easily.

Intersection is applicable when the object is far away from the instrument station which are not possible to measure directly.

Fig 1



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Identification of different wooden sample pieces for hard wood, softwood, grains and their applications

Objectives: At the end of this exercise you shall be able to
- **identify the different wooden sample pieces and their applications**
- **Identify the growth and grains**
- **identify the annual ring, knots, shakes and checks.**

Fig 1



TO BE REPUBLISHED

PROCEDURE

TASK 1: **Identify the wooden sample pieces**

Instructor shall display and demonstrate to the students regarding the different types of wooden sample pieces in the section and brief the names, soft wood, hard wood and grains and their applications and annual ring, knots, shakes, and checks.

1 Trainees will note down all the displayed wooden pieces names like a hard wood and soft wood.

2 Record them in table 1.

3 Get it checked by the instructor.

Table 1

Fig No.	Name of wood	Softwood	hardwood	Wood applications
A				
B				
C				
D				
E				
F				
G				
H				
I				

— — — — — — — —

TASK 2: **Identify the growth and grains (Fig 1)**

Table 1

Fig No.	Name of the growth/grain	Remarks
A		
B		
C		
D		
E		

— — — — — — — —

TASK 3: **Identify the annual ring, knots, shakes and checks (Fig 1)**

Table 1

Fig No.	Name of the part	defects	Remarks
A			
B			
C			
D			
E			
F			
G			
H			

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Fig 1

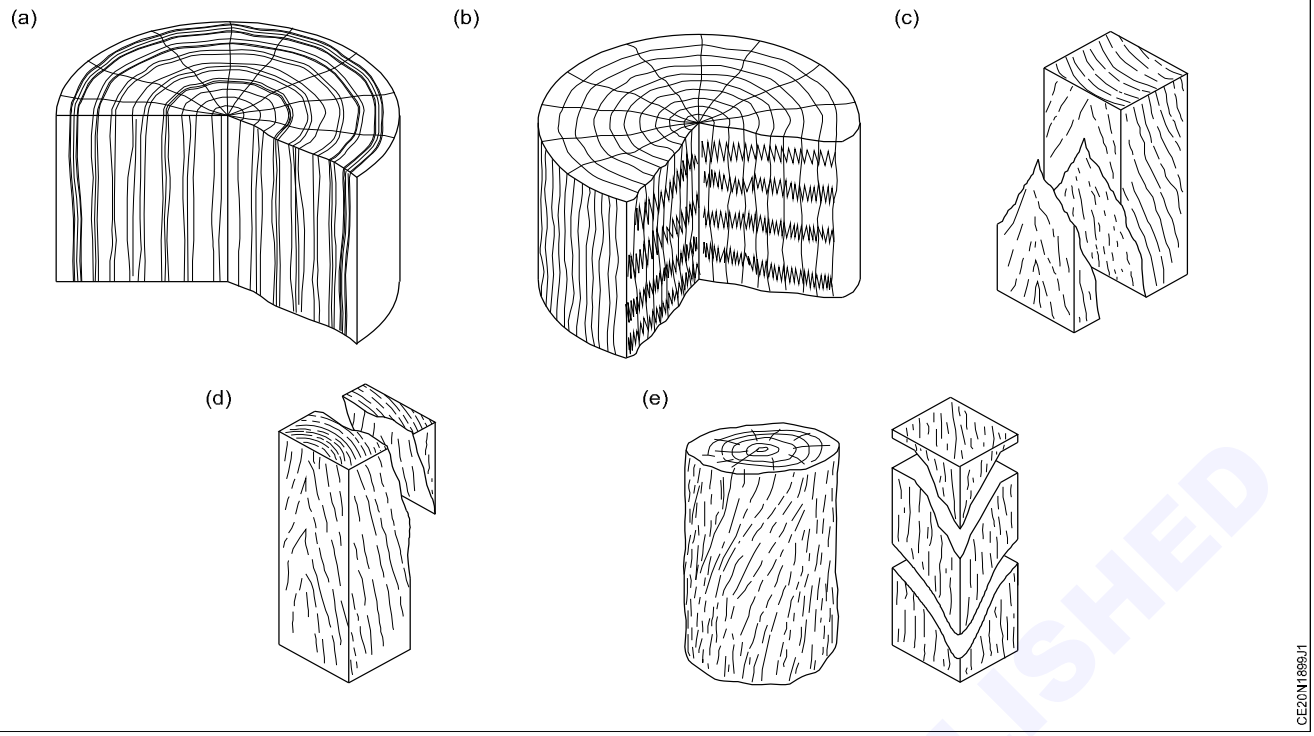
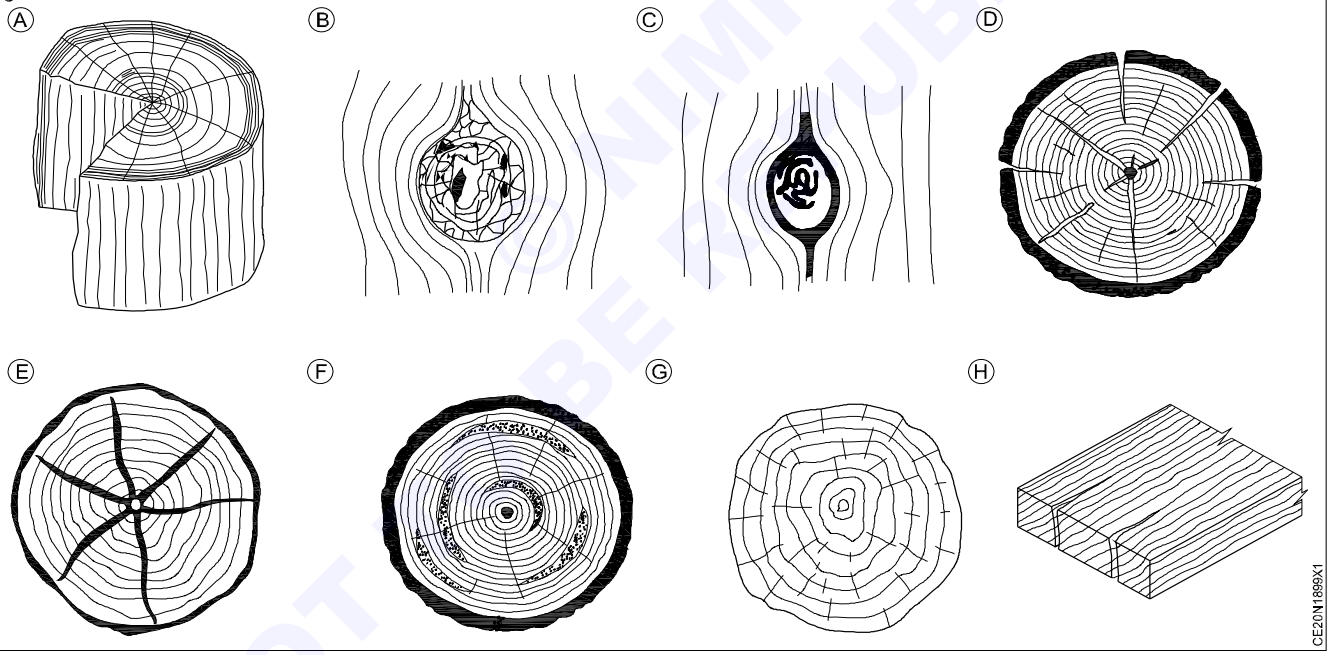


Fig 1



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Demonstrate use of carpentry hand tools, measuring, and work holding devices and their applications

Objectives : At the end of this exercise you shall be able to
- **demonstrate the measuring tools, use and their applications**
- **demonstrate work holding devices use and their applications.**

PROCEDURE

TASK 1: **Identify the measuring tools, use and their application (Fig 1) (A - H)**

Instructor shall display and demonstrate to the students regarding the carpentry hand tools, measuring tools and work holding devices name and uses.

1 Trainees will note down all the displayed measuring tools names and work holding devices.

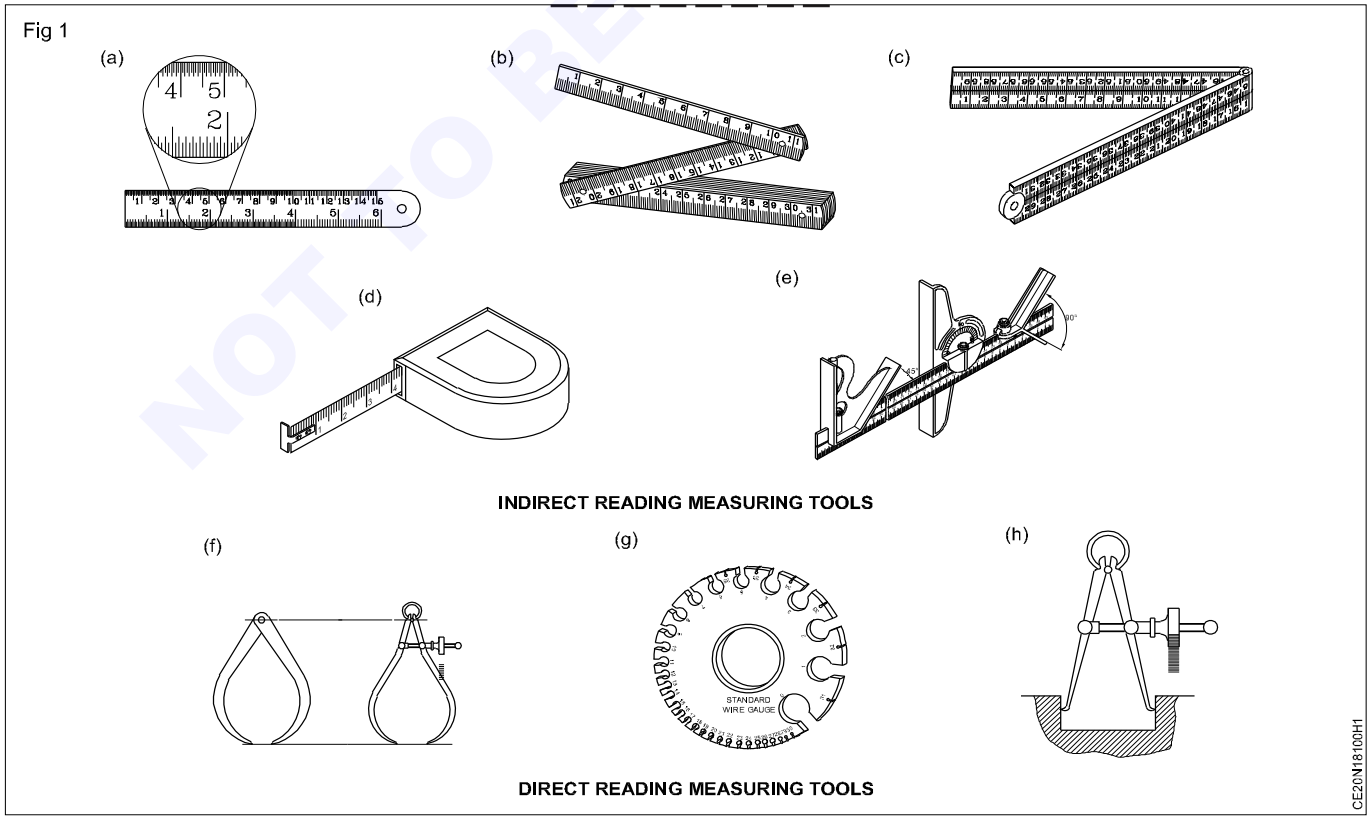
2 Record them in table 1, and 2.

3 Get it checked by the instructor.

Table 1

Fig No.	Name of tool	Uses	Tool applications
A			
B			
C			
D			
E			
F			
G			
H			

Fig 1



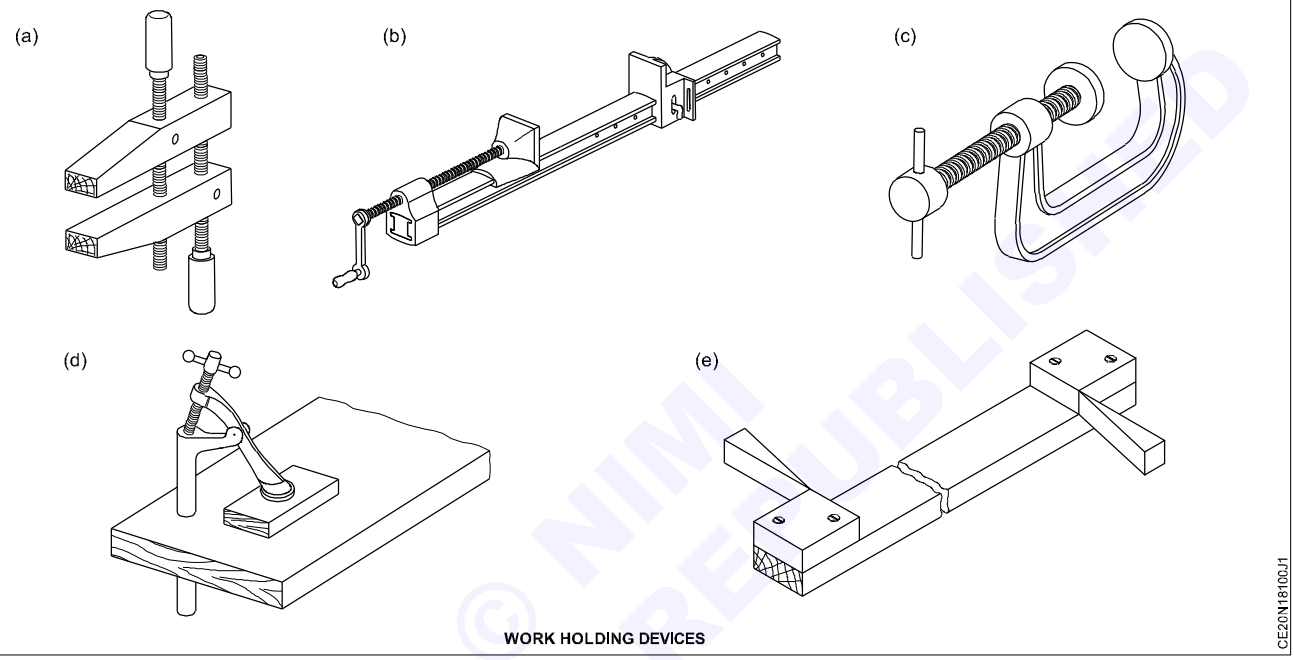
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TASK 2: **Identify the work holding devices, use and their applications (Fig 1) (A - E)**

Table 2

Fig No.	Name of tool	Uses	Tool applications
A			
B			
C			
D			
E			

Fig 2



WORK HOLDING DEVICES

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Demonstrate use of different power tools for saws, and drills

Objectives: At the end of this exercise you shall be able to
- **demonstrate the different portable power machinery**
- **demonstrate the different portable power saws and drills.**

PROCEDURE

TASK 1: **Identify the portable machinery V2 - saws and drills**

Instructor shall display and demonstrate to the students regarding the use of power machinery and power saws and power drills.

1 Trainees will note down all the displayed power machinery names and uses.

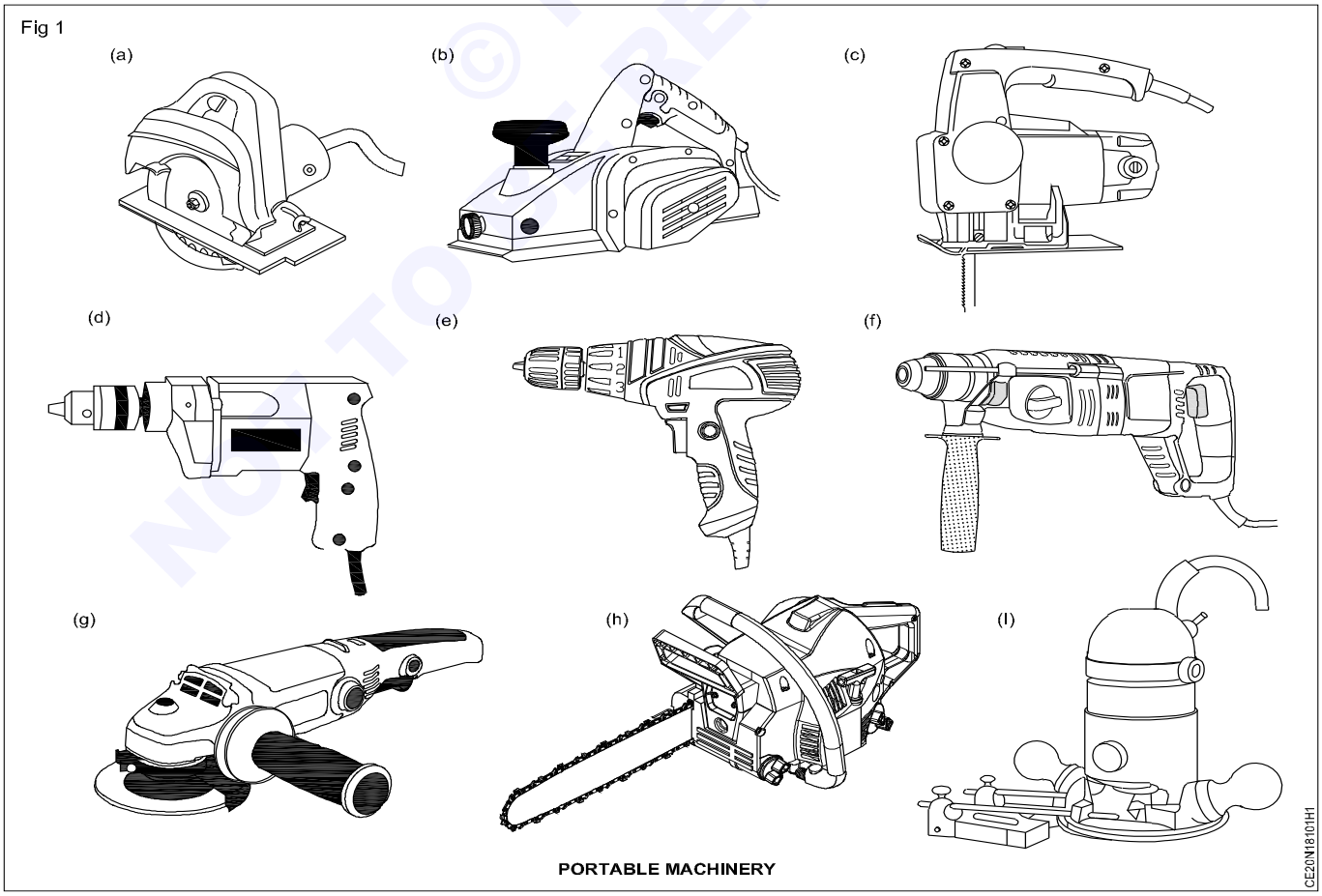
2 Record it in table 1.

3 Get it checked by the instructor.

Table 1

Fig. No	Name of the machinery	Uses	Fig. No	Name of the machinery	Uses
a			e		
b			f		
c			g		
d			h		
			i		

Fig 1



PORTABLE MACHINERY

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Perform sawing, planning, moulding, rebating, chamfering

Objectives: At the end of this exercise you shall be able to
- **sawing along the grain on bench vice**
- **planning along the grain on work bench**
- **make the moulding, rebating and chamfering**.

PROCEDURE

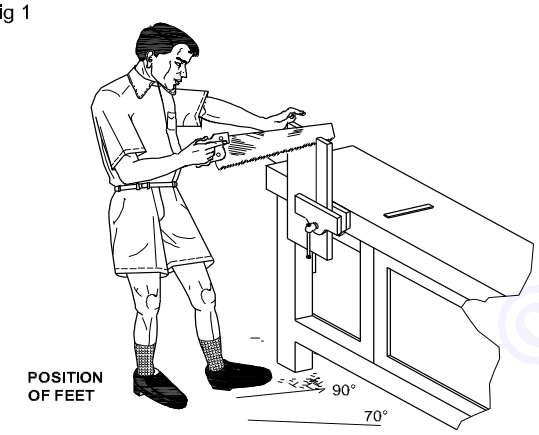
TASK 1: **Sawing**

1 Check the wooden piece size with a folding rule.

2 Mark the job as per drawing using try square and marking gauge. Hold the job firmly and vertically in the carpenter's vice vertically leaving 150mm above the vice and parallel to jaws. (Fig 1)

3 Set and mark the saw. Grip the saw handle with right hand index finger along the side. (Fig 1)

Fig 1



SAWING ON CARPENTER BENCH VICE

Precaution

- **Clean the wooden piece on all sides with sand stone.**

4 Place the saw on marked line at an angle of 65°.

5 Hold the handle to form an angle of 65^0 with job. (Fig 1)

6 Move the saw forward and backward with even pressure to form a saw cut using left hand thumb as a guide.

7 Saw to a depth of 400mm on marked line of the job.

8 Repeat the sawing for the other marked lines.

9 Finish the rip sawing.

TASK 2: **Planning along the grain on wood**

1 Place the job against bench and the index finger on the side.

2 Place the palm of left hand on the toe of the plane thumb and finger on the side. (Fig 1)

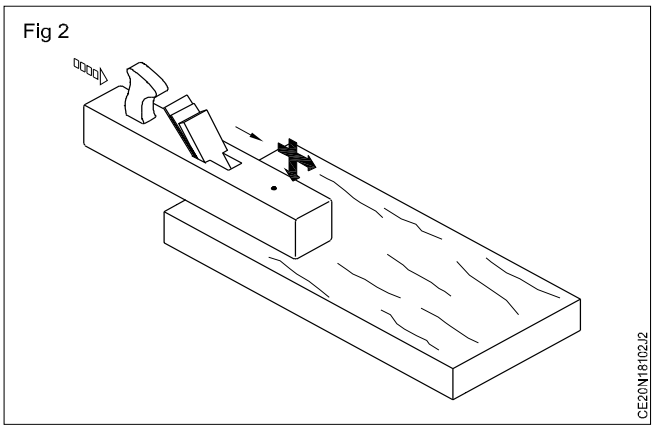
Fig 1



3 Stand near the bench with left foot forward at 70° with neck and the right at a convenient distance.

4 Place the plane straight on the job and give forward stroke. (Fig 2)

Fig 2



5 Release the pressure on the back stroke and merely draw the plane to the first position.

6 Check the flatness of the surface occasionally with try square or straight edge.

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7 Repeat the procedure till the surface becomes flat.

8 Clean the job and clean the bench and tools.

Precautions

Do not give pressure by right hand when you start the planning.

Do not put pressure by left hand at the end of the stroke.

Try to plane the wood uniformly.

Do not plane continuously without checking the surface.

Do not take a big cut for finishing.

Keep the plane when not is use on its side and not on its cutting edge.

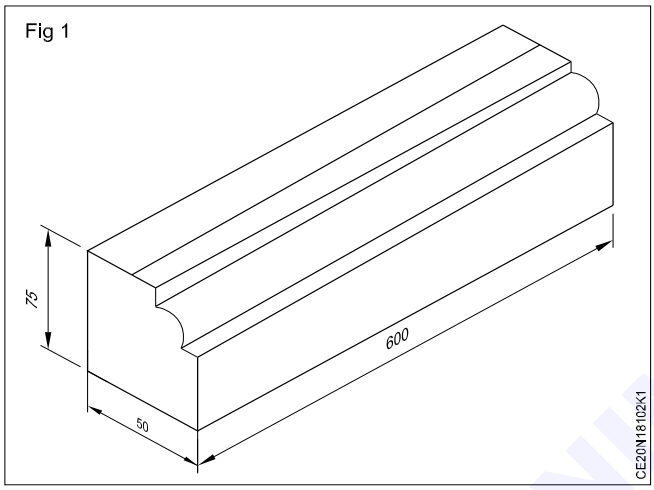
9 Finish the planning operation.

— — — — — — — —

TASK 3: **Sawing for (moulding) operation with portable router machine**

1 Check the planed plank for required length, width and thickness to make moulding. (Fig 1)

Fig 1



2 Mark the dimension of moudling on plank using mortise gauge and steel rule as per drawing.

3 Select portable power router machine (Fig 2)

4 Select the router bit. (Fig 3)

5 Set the router gauge to the required distance from the router bit.

6 Set the router bit at distance of moulding above the table.

7 Check the measurements.

8 Switch on the machine.

9 Keep the plank horizontal on the table against the bit.

10 Move the router against the plank and facing with guide slowly and evenly for first moulding cut.

11 Switch off the machine.

12 Adjust the router bit to required distance from router bit for second cut.

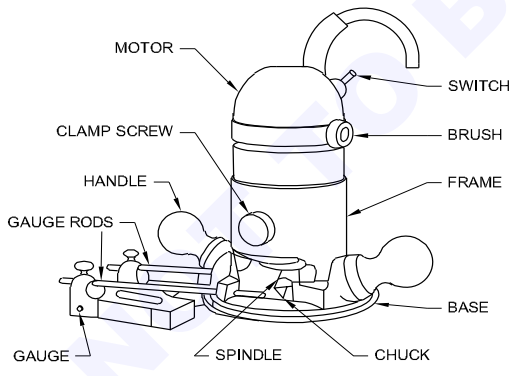
Switch off main power to change blade.

Do not allow scrap to accumulate on the table.

13 Switch off the machine after work.

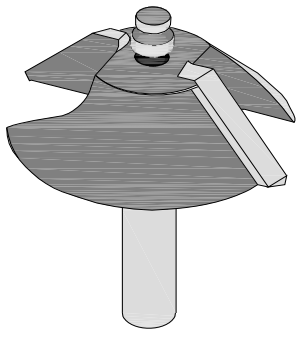
14 Finish the moulding operation as per drawing.

Fig 2



PARTS OF PORTABLE ELECTRIC ROUTER

Fig 3



ROUTER BIT

— — — — — — — —

TASK 4: **Sawing for rebating operation with portable circular saw machine**

1 Check the planed plank for required length, width and thickness to make rebating.

2 Mark the dimension of rebating on plank using marking gauge and steel rule as per drawing. (Fig 1)

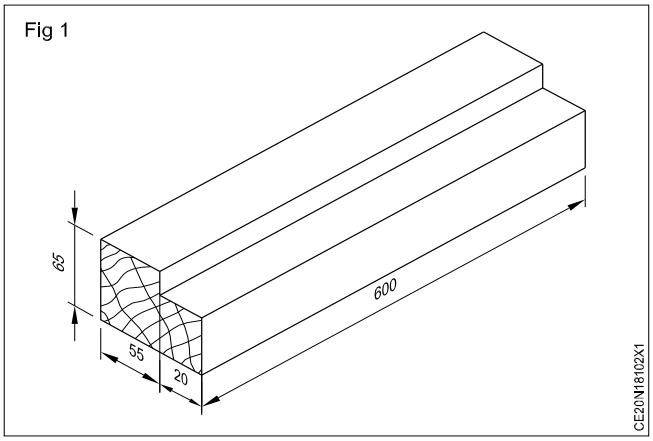
3 Set the saw blade at a distance of 20mm above the table to cut depth of rebating.

4 Check the required measurement keeping the plank against the fence and saw blade by rotating the saw blade by hand.

5 Switch on the machine. Keep the plank vertically on the table against the saw blade.

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Fig 1



6 Push the plank gently with even pressure against the saw blade facing with fence. (Fig 2)

7 Switch off the machine.

8 Set the fence at a distance of 10 mm from the saw blade to cut the shoulder portion of rebating.

9 Set the saw blade at a distance of 10 mm above the table.

10 Keep the plank flat on the table against the saw blade.

11 Check the measurements before cutting.

12 Switch on the machine.

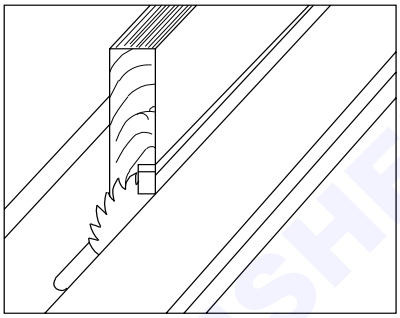
13 Move the plank gently with even pressure against the saw blade facing with fence.

14 Switch off the machine after work.

15 Remove the waste portion of the rebating.

16 Check the rebating as per drawing.

Fig 2



— — — — — — — —

TASK 5: **Chamfering operation by surface with portable planning machine**

1 Check the planed wood for required size using foot rule.

2 Mark the dimension of chamfering as per drawing using foot rule, marking gauge.

3 Set the planer blade in the cutter head to make chamfering operation.

4 Set the front table and rear table.

5 Set the fence at 35° for supporting work when planning chamfering.

6 Place the wooden piece on the table.

7 Switch on the machine.

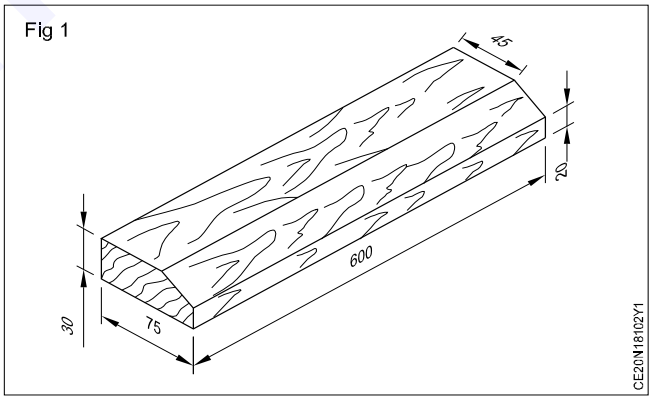
8 Plane the chamfering side by moving the wood piece against the cutter hand.

9 Repeat the same procedure to chamfer the wooden piece to the required size as per drawing.

10 Stop the machine and check the chamfering with level square.

11 Finish the chamfering operation (Fig 1)

Fig 1



— — — — — — — —

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Sharpening and setting of saw blade and planer blade

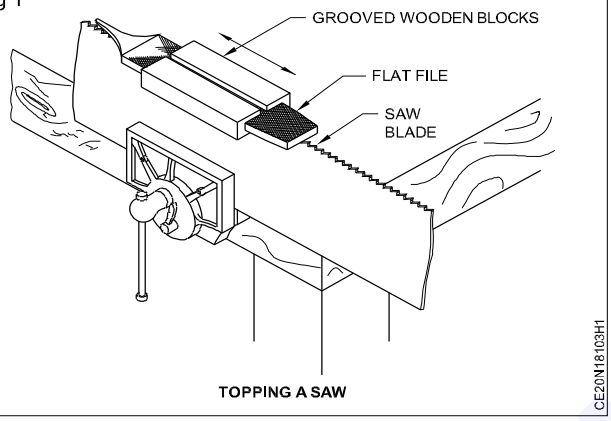
Objectives: At the end of this exercise you shall be able to
- **sharpening and setting of saw blade and planner blade.**

PROCEDURE

TASK 1: **Sharpening and setting of saw blade**

Topping (Fig 1)

Fig 1



TOPPING A SAW

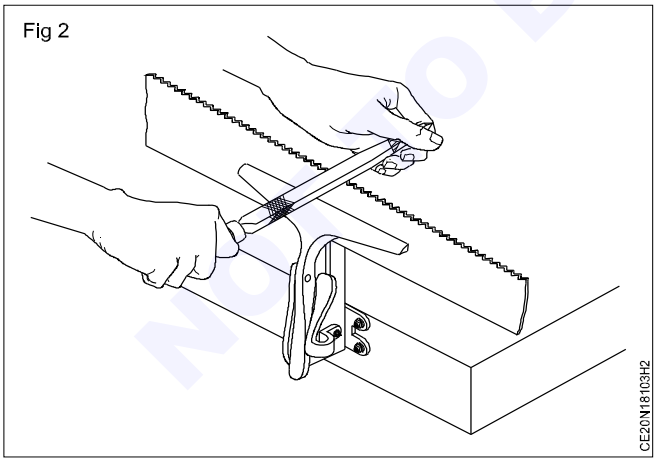
1 Fix the saw in the saw vice if required by keeping a waste wooden piece on both the sides of jaws.

2 Set the flat in the grooved wooden block to level all the teeth by running a fine flat file, along the length of the saw teeth.

3 The file must be kept flat and passed lightly, over the tops of the teeth and levelled.

Re-shaping (Fig 2)

Fig 2



1 File all the teeth to their correct shape and size with slim taper triangular saw file,

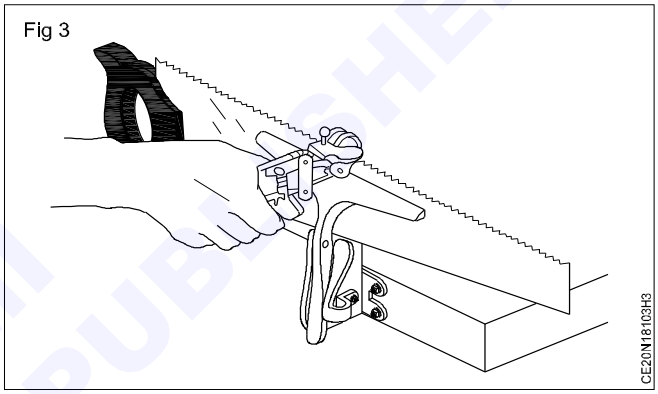
2 Maintain the same grip throughout filing.

3 File each gullet until teeth of the finished side hits a point and half the flat on the next teeth is filed away.

4 At the end of the reshaping process, the teeth should all be in one and the same level and shape.

Saw setting (Fig 3)

Fig 3

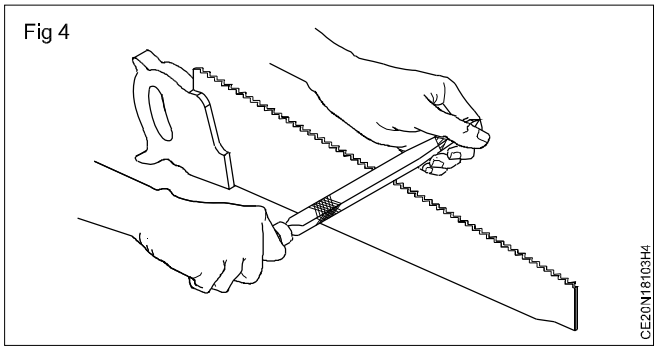


1 When a saw is being set the blade should be fastened into the saw clamp.

2 When one row of the teeth has been set, the saw is reversed in the clamp and then the other row is bent.

Sharpening (Fig 4)

Fig 4



1 Select a tapered triangular saw file with slightly round comer.

2 Start sharpening at the point of the saw.

3 Sharp the tooth of the saw at 30° to 45°.

4 Remove the burr produced by the file by passing an oil stone lightly along the side of the teeth.

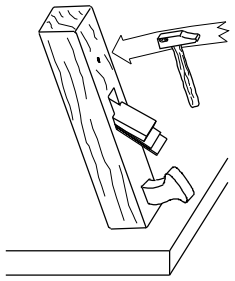
5 Check the saw teeth.

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TASK 2: **Grinding and sharpening process of the plane blade/cutter**

1 Remove cutting iron, cap iron and the wedge from the jack plane by slightly striking by hammer (Fig 1).

Fig 1



RELEASING THE PLANE

CE20N18103J1

2 Select the grinding wheel

3 Check the grinding wheel for cracks

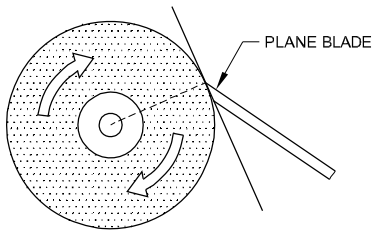
4 Ensure that there is enough coolant in the container. Lower the protecting shield near the tool rest.

5 Adjust the tool rest 2mm closer to the wheel, if necessary

6 Switch on the grinder machine

7 Hold the cutting bevel across of the cutting iron must at an angle of 20° to 25° (Fig 2).

Fig 2



GRINDSTONE WHEEL

CE20N18103J2

8 Rest the body of the cutting iron on the tool rest allow the point to touch the wheel.

9 Keep the pressure as minimum as possible to prevent excessive heating of the cutting bevel.

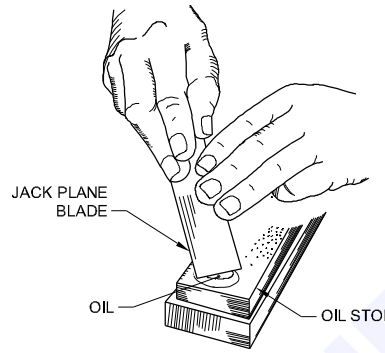
10 Dip the cutting iron in a coolant frequently.

11 Finish the grinding of cutting iron with oil stone

Avoid blue colour from cutting edge I.C annealing effect

12 Place the blade until the cutting edge is parallel on the stone. (Fig 3)

Fig 3



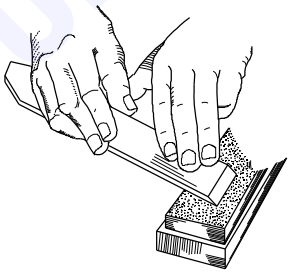
CUTTING IRON SHARPENING

CE20N18103J3

13 Move the blade backward and forward on width of the stone until a burr is formed on the flat side of the blade.

14 Turn the blade over and hold it perfectly flat on the stone. Rub from side to side until burr has disappeared to get fine cutting edge. (Fig 4)

Fig 4



CE20N18103J4

15 Continue the sharpening procedure till you get fine cutting edge.

16 Reset the cap iron and cutting iron keeping a gap of 1mm and the wedge of jack plane

— — — — — — — —

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Planning face side and face edge

Objectives: At the end of this exercise you shall be able to
- **plane a wooden piece to face side and face edge.**

PROCEDURE

TASK 1: **Plane the face side and face edge**

- Set the jack plane for planning.
- Place the job on the work bench or hold the job on the carpenter's vice with face side up.
- Keep the packing piece between the job and the vice.
- Keep the job horizontally flat in the vice.
- Start planning the face side with jack plane refer to exercise 1 - 8 - 102 task 2.
- Check its flatness with try square.
- Mark the face side on the job using pencil.
- Place the face edge up and hold it in the vice with packing piece.
- Plane it along the face edge.
- Check its squareness and flatness of the job.
- Mark the face edge on the job using pencil.
- Gauge to the required width of 100mm on both sides using the marking gauge from the face edge. Plane down the gauge lines. Test for straightness and squareness. (Fig 1)
- Set the marking gauge 21mm for the required thickness.
- Gauge to the required thickness of 21mm from the face side using marking gauge on both the edges. Plane down the gauge lines. Test for flatness. (Fig 2)

Fig 1

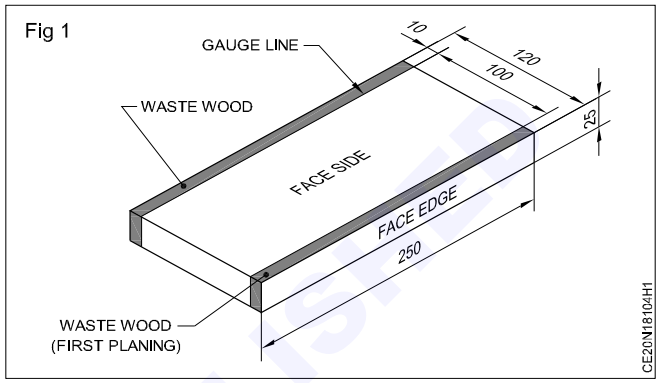
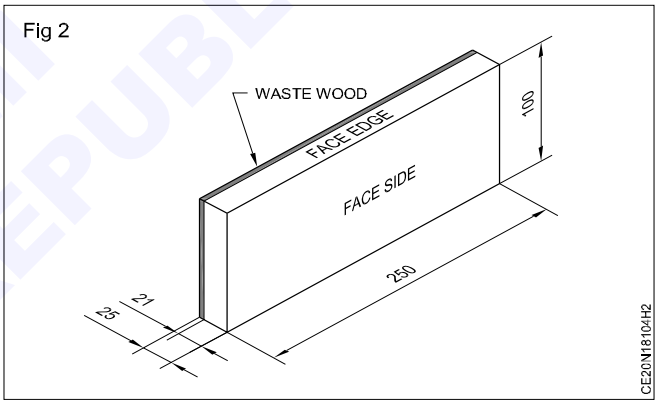


Fig 2



Note: While planning keep the left foot in forward position and parallel to the work bench. Right foot obliquely under the work bench. Right fore arm should be in line with the plane. Left hand is held on the front part of the plane. Planning should be in the direction of grain.

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Demonstrate the use of marking gauge and mortise gauge

Objective: At the end of this exercise you shall be able to
- **demonstrate the use of marking gauge and mortise gauge.**

PROCEDURE

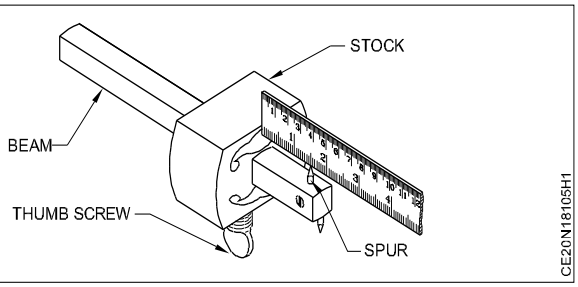
Instructor shall display and demonstrate to the students regarding the use of marking and mortise gauge.

TASK 1: **Perform the marking gauge and their application**

1 Hold the gauge in left hand keeping the spur up.

2 Hold the steel rule in right hand and set the required distance between stock and spur. Keep the direction of steel rule in front. (Fig 1)

Fig 1



3 Adjust the stock with the help of left hand thumb, and index finger. Now the marking gauge is set. Tighten the thumb screw.

4 Check the measurement of accuracy.

5 Hold the gauge stock in right hand thumb on top.

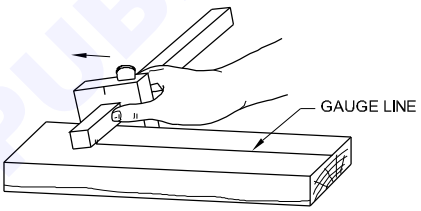
6 Place one end of the piece against the bench stop and other end in left palm.

7 Place gauge stock in contact with the face edge of the piece and spur touching the piece lightly in slanting position

8 Give forward stroke on the stock near the end (Fig 2)

9 Hold the piece in left hand and complete the gauge mark, and check the gauge mark with steel rule.

Fig 2

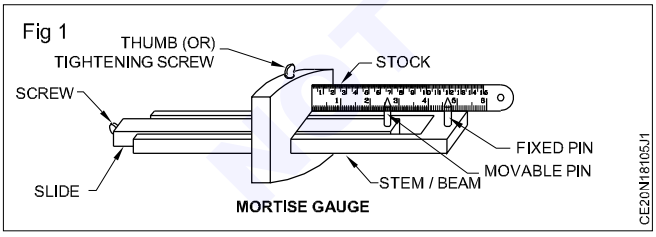


TASK 2: **Perform the mortise gauge and their application**

1 Hold the gauge in left hand keeping the spur up.

2 Hold the steel rule in right hand and set the required distance between stock two spurs can be spaced at different distance and mark two parallel lines at a time. Keep the direction of the steel rule in front. (Fig 1)

Fig 1



3 Adjust the stock with the help of left hand thumb, and index finger. Now the mortise gauge is set. Tighten the thumb screw.

4 Check the measurement for accuracy.

5 Hold the gauge stock in right hand thumb on top.

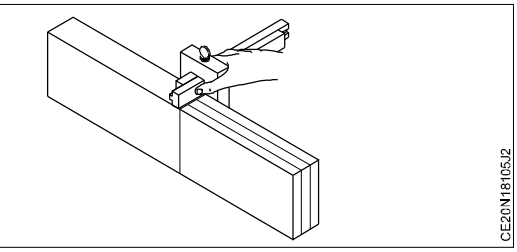
6 Place one end of the piece against the bench stop and other end in left palm.

7 Place gauge stock in contact with the face edge of the piece and spur touching the piece lightly in slanting position

8 Give forward stroke on the stock near the end.

9 Hold the piece in left hand and complete the gauge marking parallel lines of tenons. (Fig 2)

Fig 2



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Test the accuracy of flatness and twistness of the surface by using try square

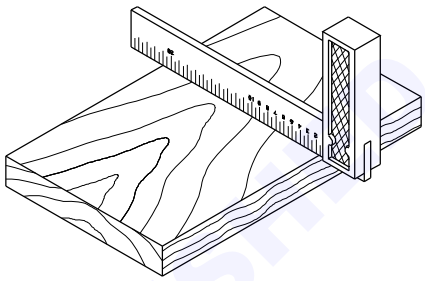
Objective : At the end of this exercise you shall be able to
- **test the accuracy of flatness, squareness and twistness.**

PROCEDURE

TASK 1: **Test the accuracy of the flatness (Fig 1)**

1 Place the job on the work bench.
2 Hold the try square in right hand.
3 Test the flatness of the surface.

Fig 1



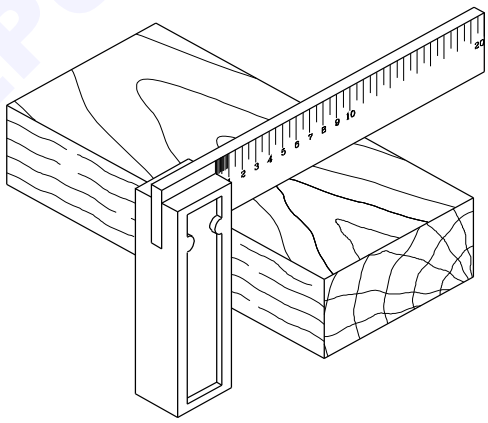
SURFACE CHECKING

CE20N18106H1

TASK 2: **Test the accuracy of the squareness (Fig 1)**

1 Place the job on the work bench.
2 Hold the try square in right hand.
3 Test the squareness of the job.

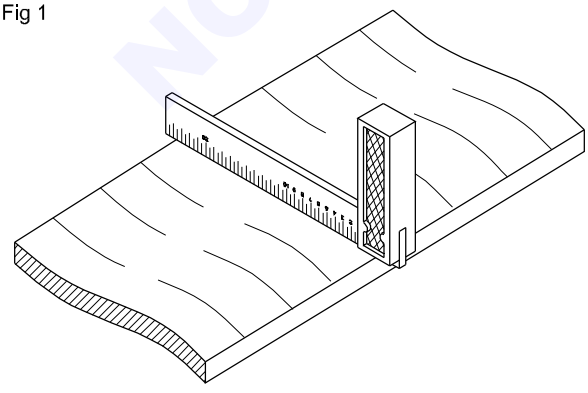
Fig 1



CE20N18106J1

TASK 3: **Test the accuracy of the twistness on surface (Fig1 & 2)**

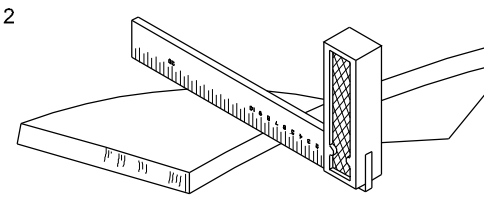
Fig 1



CE20N18106X1

1 Place the job on the work bench.
2 Hold the try square in right hand.
3 Test the twistness on surface.

Fig 2



CE20N18106X2

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Demonstrate the use of winding strips, cross planning and edge planning

Objectives: At the end of this exercise you shall be able to
- **demonstrate the winding strips**
- **plane the cross grain and edge.**

PROCEDURE

TASK 1: **Winding strips tools (Fig 1)**

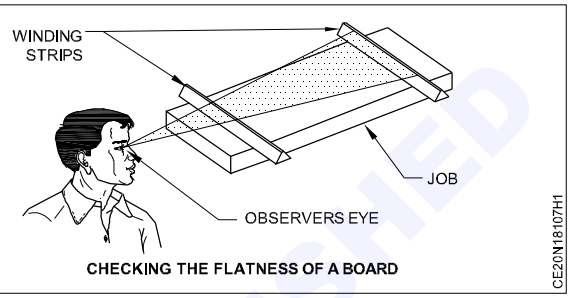
Instructor shall display and demonstrate to the students regrading the use of winding strips, cross and edge planning.

1 Trainees will note down all the displayed testing tools name and uses.

2 Record it in table 1.

3 Get it checked by the instructor.

Fig 1



CHECKING THE FLATNESS OF A BOARD

Table 1

Fig No.	Name of the testing tools	Uses
1		

— — — — — — — —

TASK 2: **Cross planning**

1 Set the jack plane for planning.

2 Place the job on the work bench or hold the job on the carpenter's vice with face side up.

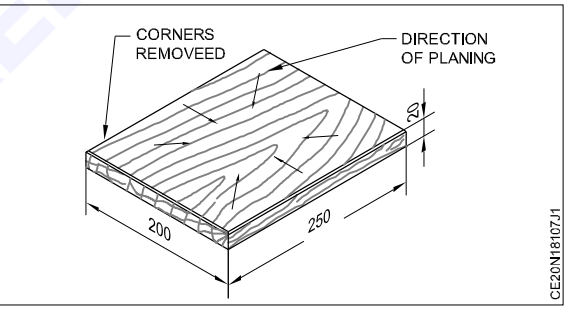
4 Tight the job 15mm above the vice, keeping the packing piece sidewards.

5 First plane along the grain in one edge. Then plane from the other edge.

6 Plane diagonally from one edge of the corner to the other.

7 Plane towards the middle from the edges (Fig 1). Check flatness with try square and straight edge.

Fig 1



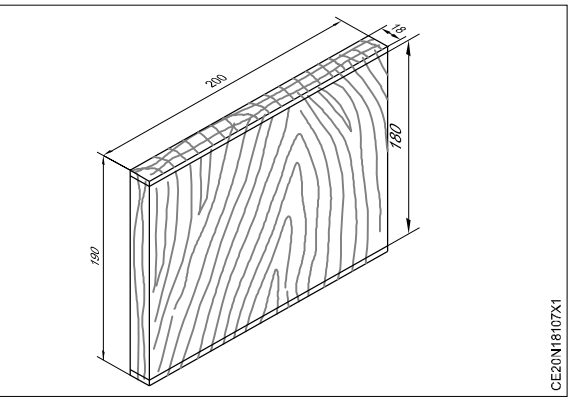
8 Plane again if high spots are found repeat the procedure till you get a levelled surface.

— — — — — — — —

TASK 3: **Edge planning**

1 Check the measurements of the job.
2 Trim off the corner with firmer chisel to avoid splintering.
3 Hold the job in the vice.
4 Before starting to plane, clamp a waste piece of wood behind the corner to avoid splintering of the job. (Fig 1)
5 Start planning from one end.
6 Continue the planning till you get a levelled surface.
7 Start planning from the other end.
8 Continue the planning from both end towards middle till you get a levelled surface.
9 Check the levelled surface with a try square.
10 Repeat the same procedure for other end.

Fig 1



— — — — — — — — —

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Demonstrate the portable power planer machine and its function

Objectives: At the end of this exercise you shall be able to
- **demonstrate the portable power planer machine**
- **planning the surface.**

PROCEDURE

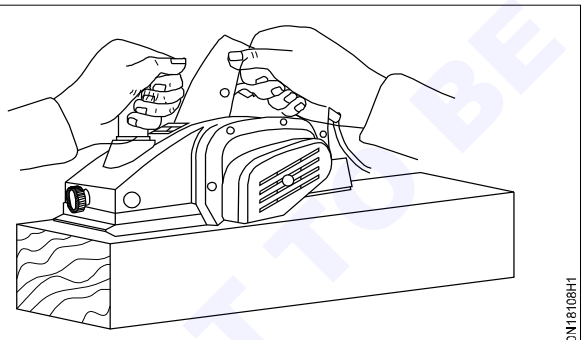
TASK 1: **Demonstrate the portable power planer**

Instructor shall display and demonstrate to the students regarding function of portable power planer machine.

TASK 2: **Planning the surface**

- Sharpen the planer blade using oil stone
- Set the planer blade in the cutter head using allenkey
- Set the infeed table and out feed table
- Place the job against bench stop
- Hold the plane with the right hand keeping the index finger on the trigger switch.
- Place the left hand on the front handle of the plane
- Trigger switch on the machine
- Place the machine straight on the job and give forward stroke (Fig 1)

Fig 1

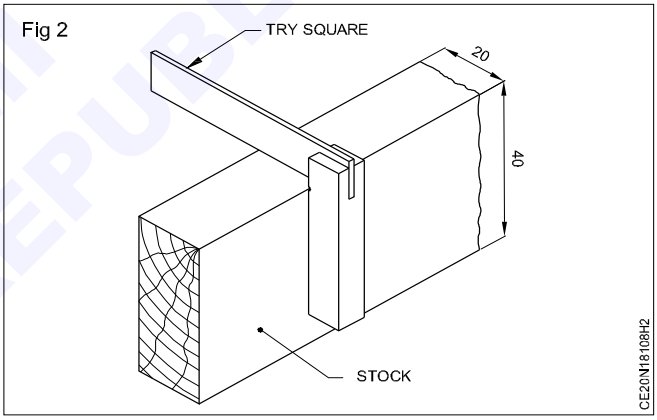


MACHINE STRAIGHT STOCKS

CE20N18108H1

- Main objective is to keep the machine always horizontal
- Feed the job against the cutter head for planning to required size.
- Trigger switch off the machine
- Check the flatness and thickness of planed wooden piece using try square and steel rule. (Fig 2)

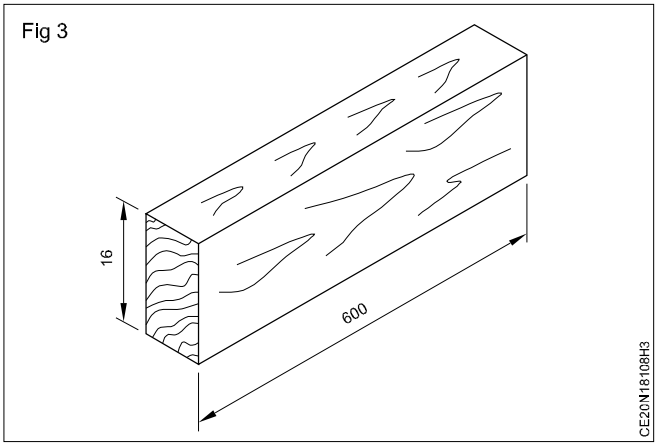
Fig 2



CE20N18108H2

- Finish the job (Fig 3).

Fig 3



CE20N18108H3

keep the machine on its side when not in use

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Single and double mortise and tenon joint, plain hunched corner mitre joint

Objectives : At the end of this exercise you shall be able to
- **make single and double mortise and tenon joint**
- **make plain hunched and corner mitre joint.**

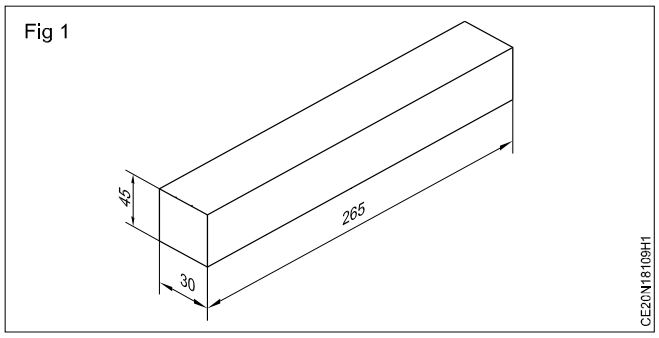
PROCEDURE

TASK 1: **Making the mortise and tenon joint**

1 Check the wooden piece for its size using folding rule.

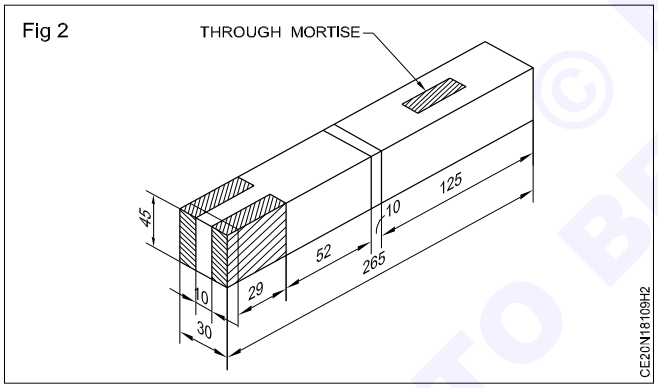
2 Plane it to size where in the width = 45 mm Thickness = 30 using jack plane. (Fig 1)

Fig 1



3 Mark the given dimension on the job as per drawing using scriber, folding rule and try square. (Fig 2)

Fig 2



4 Set the 1/3rd (one third) thickness in mortise gauge and scribe marking out lines on edges and ends of the job as per drawing

5 Hold the work piece in the vice. (Fig 3)

6 Hold the mortise chisel (6 mm) in left hand and the mallet in the right hand, start chopping out the mortise at a distance of 2 mm from the lines. (Fig 4)

7 Chop out first layer about 10 mm and then cut next layer until half the height is reached.

8 Reverse the work piece upside down in the vice and start chopping out from the other side.

9 Check whether the walls of mortise are straight.

10 When the mortise holes are finished to size clear the mortise using mortise and firmer chisel.

Fig 3

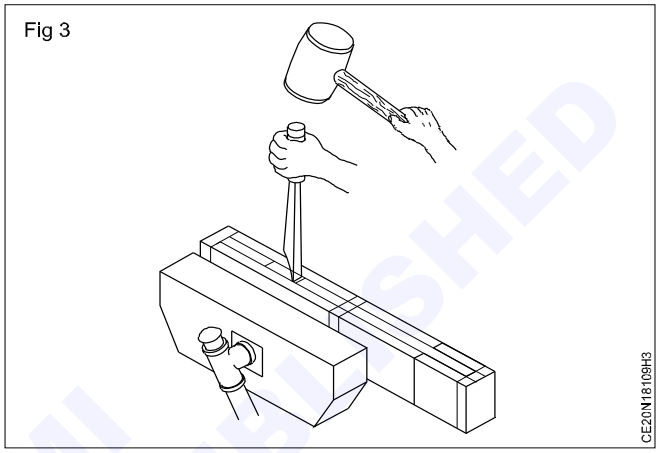
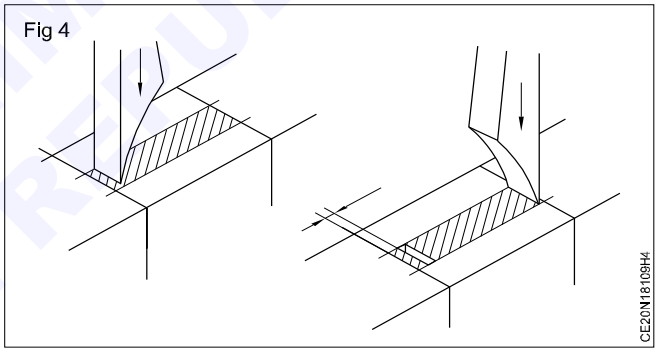


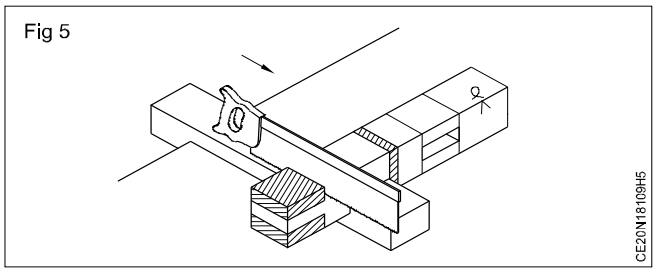
Fig 4



11 Saw the tenon walls right upto the lines of the shoulder, with the use of bench hook.

12 Saw down the tenon walls of the tenons. (Fig 5)

Fig 5



13 Saw off the end wastes of tenon and finish the flat surfaces. (Fig 6)

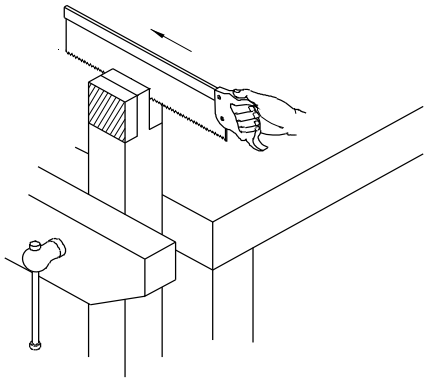
14 When two pieces are ready to be fit, check if they will fit snugly and are flush when fitted. (Fig 7)

15 Fit the mortise with their tenons and after fitting there should not be any movement in the joints. (Fig 7)

16 Finish the mortise and tenon joint with smoothing plane. (Fig 7)

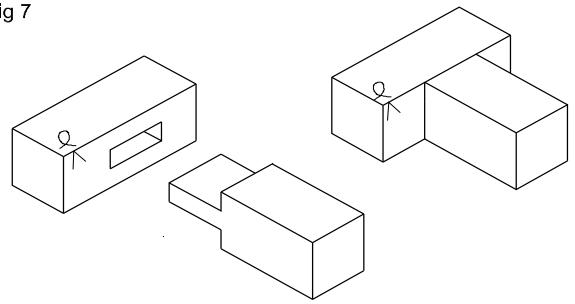
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Fig 6



CE20N18109H6

Fig 7

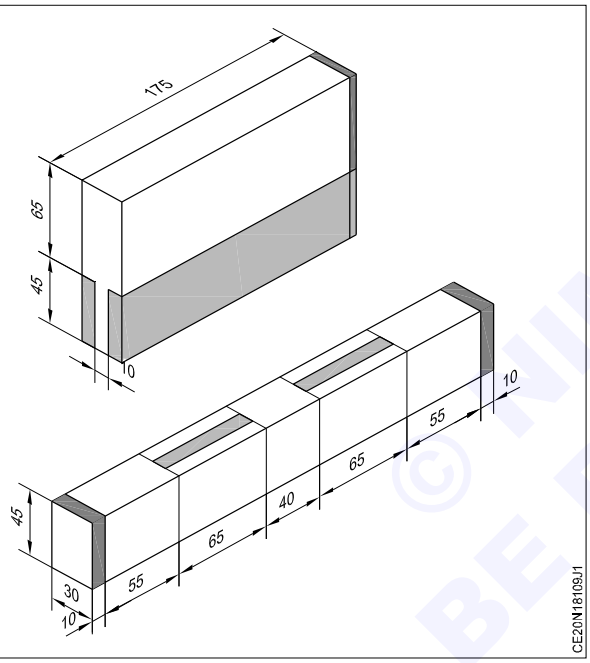


CE20N18109H7

TASK 2: **Make a double tenon and mortise joint**

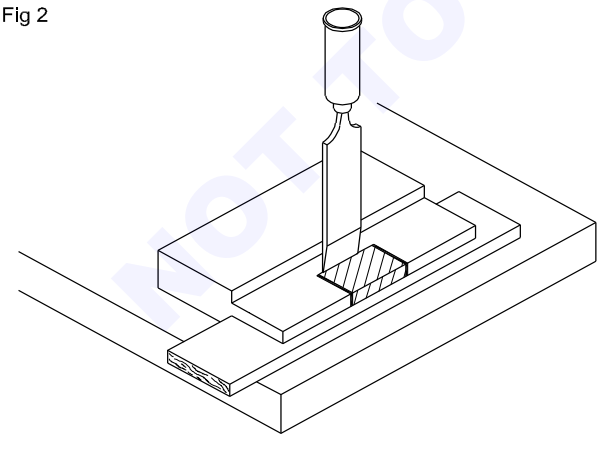
1 Planning marking (Fig 1) mortising (Fig 2) tenoning (Fig 3) and assembling process refer task 1

Fig 1



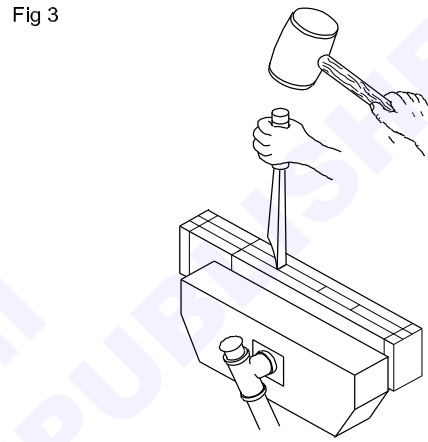
CE20N18109J1

Fig 2



CE20N18109J2

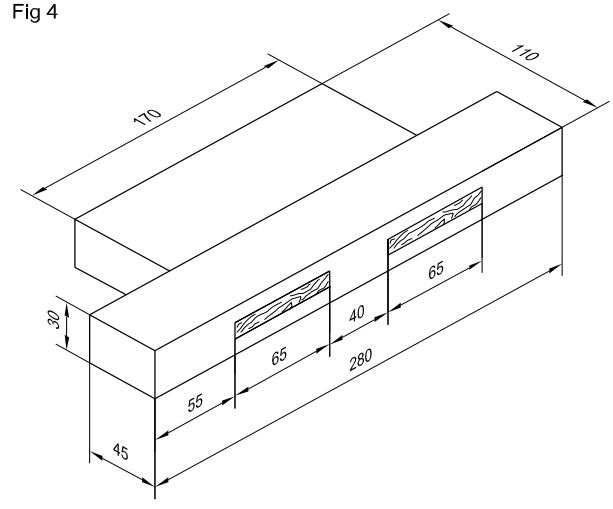
Fig 3



CE20N18109J3

2 Assemble the tenon and mortise properly and finish the joint. (Fig 4)

Fig 4



CE20N18109J4

TASK 3: **Plain haunched mortise and tenon joint**

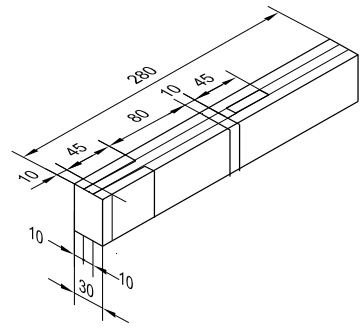
1 The stock should be planed to the required size in the usual way called truing - up - the stock using jack plane

2 After truing up the size of the work piece 45 x 30 x 280mm.

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3 Marking as per the drawing using folding rule, try square, mortise gauge and scriber. (Fig 1)

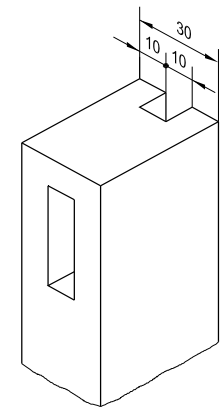
Fig 1



4 Preparing mortise and tenon process refer to task 1

5 Hold the mortise upside down and prepare the hunch to a size of 10 x 10 x 10mm. (Fig 2)

Fig 2



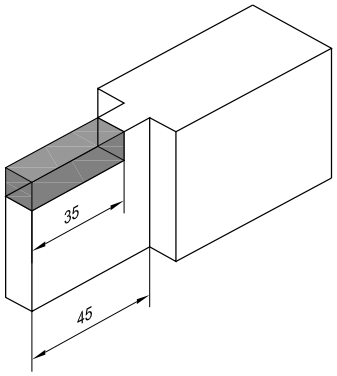
HAUNCHED PART OF THE MORTISE

6 Finish the haunches and smoothen and flatten the surface with mortise and firmer chisel.

7 Hold the tenon vertically on the vice and cut away the 1/3 part marked as per drawing. (Fig 3)

8 Finish the surfaces and flatten it smoothly using firmer chisel.

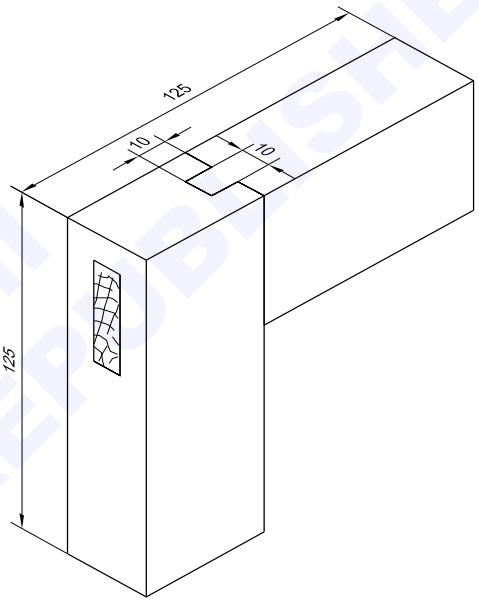
Fig 3



9 Haunched mortises and tenons are ready

10 gently tapping it with mallet and finish the job as per drawing. (Fig 4)

Fig 4



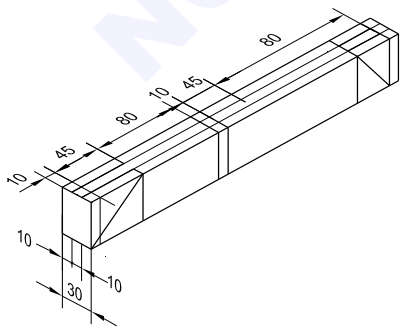
ASSEMBLED VIEW OF HAUNCHED MORTISE AND TENON

TASK 4 : **Mitre corner mortise and tenon joint**

1 The stock should be planed to the required size in the usual way called truing - up - the stock.

2 Mark the job as per the drawing using folding rule try square and scriber. (Fig 1)

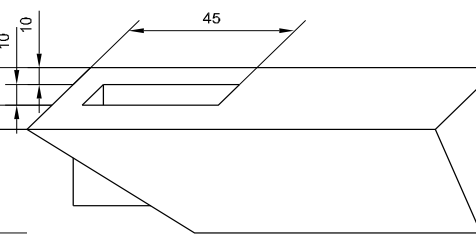
Fig 1



3 Preparing the mortise process refer to task - 1

4 Leave 10 mm margin from left sides. Cut to a 10 mm thickness on the line marked at 45° angle with tenon saw and finish the mortise. (Fig 2)

Fig 2



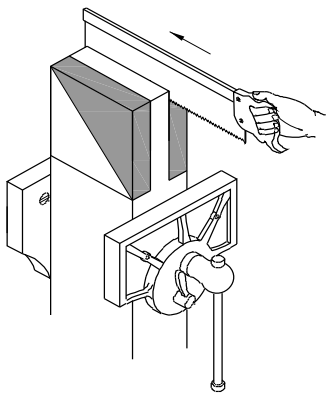
PART OF THE MORTISE

5 Hold the mitre tenon vertically on the vice and cut away the 1/3 part marked as per drawing (Fig 3).

6 Reverse the piece in the vice and go on sawing 45° angular line with tenon saw as per drawing. (Fig 4)

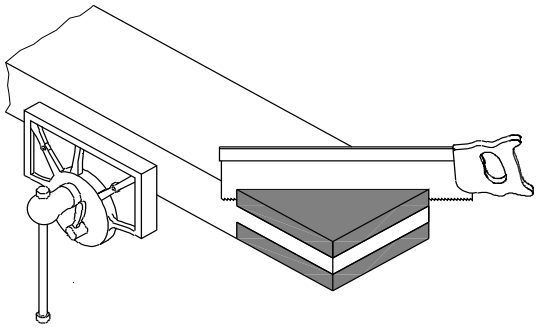
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Fig 3



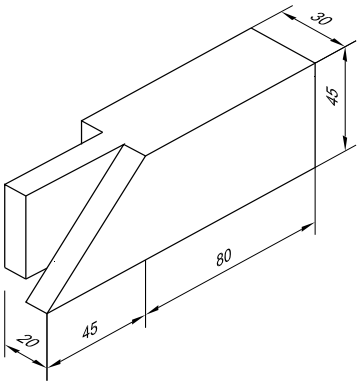
CE20N18109Y3

Fig 4



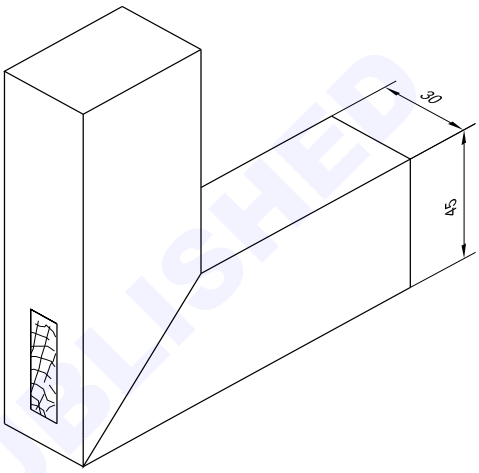
CE20N18109Y4

Fig 5



CE20N18109Y5

Fig 6



ASSEMBLED VIEW OF MITRE CORNER MORTISE AND TENON

CE20N18109Y6

7 Finish the tenon surfaces and flatten it smoothly using firmer chisel. (Fig 5)

8 Mitre mortise and tenons are ready

9 Assemble the tenon in the mortise by gently tapping it with mallet and finish the job as per drawing. (Fig 6).

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Full housing, stopped housing joint and bridle joint

Objective : At the end of this exercise you shall be able to
- **make a full, stopped housing and bridle joint.**

PROCEDURE

TASK 1: **Make full housing joint**

1 Check the wooden piece for its size using four fold wooden rule.

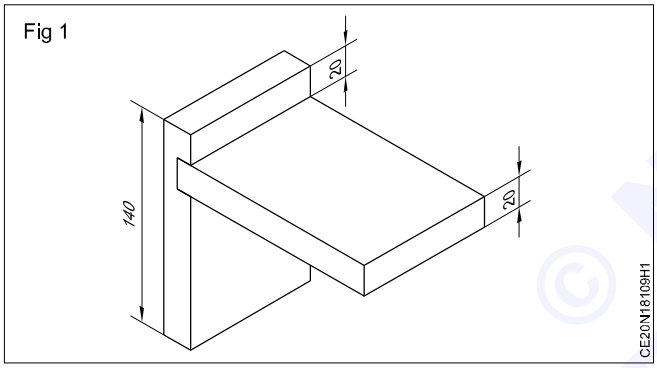
2 Plane the raw material to the required size using jack plane.

3 Plane it squarely to the size of 90 x 20 x 300mm.

4 Cut the wooden piece into two pieces with a tenon saw to the size of 90 x 20 x 140mm to square.

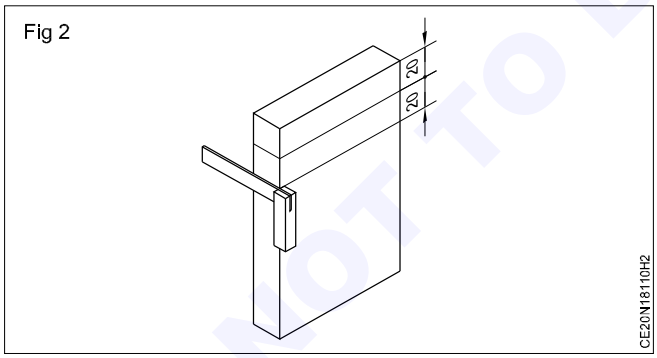
5 Mark the dimensions on trench piece as per drawing. using try square marking gauge, scriber and pencil (Fig 1).

Fig 1



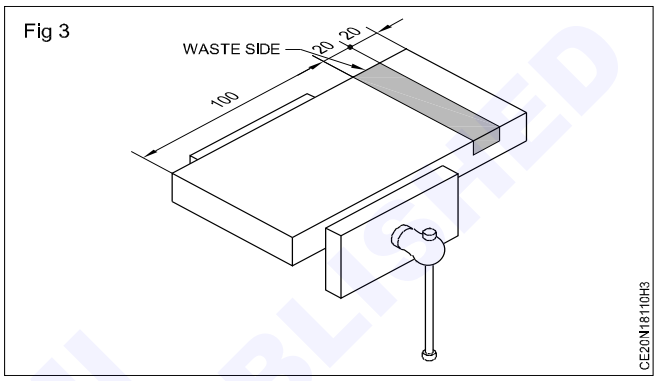
6 Finish the lines with try-square and mark on the edge sides. (Fig 2)

Fig 2



7 Mark 10mm housing depth on both the edges using marking gauge. (Fig 3)

Fig 3



8 Place the wood in the vice. (Fig 4)

9 Cut the sides of the housing down to the centre line using tenon saw. (Fig 4)

10 Remove the excess wood using firmer chisel. (Fig 4)

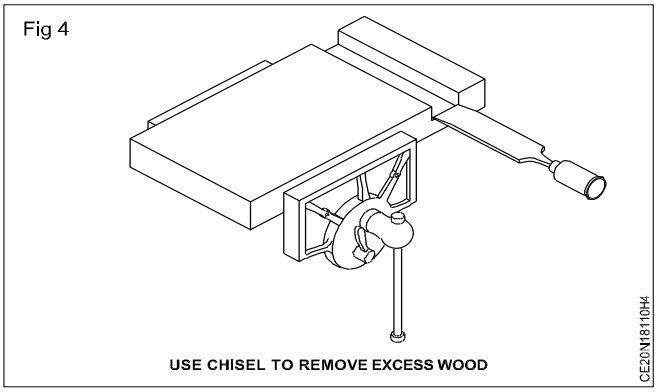
11 Place the end of the other piece in the housing.

12 If the housing is tight parallel the sides slightly with the chisel and clean it.

13 Assemble the job (Fig 1)

14 Check the accuracy of the inside squareness using try square.

Fig 4



TASK 2: **Make a stopped housing joint**

1 Check the wooden piece for its size (300x100x25mm) using folding rule.

2 Plane the raw material to the required size using jack plane.

3 Plane it squarely (with 90° sides) to the size 90 x 20 x 300mm using try square.

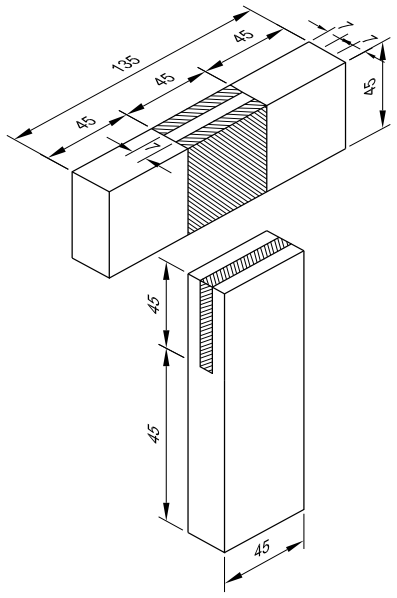
4 Mark the width of the trench on the job as per drawing. (Fig 2 a, b, c)

Care should be taken to see that the cut is not extended beyond the shoulder line.

5 Make the width of the trench on the job as drawing (Fig 2 & 3)

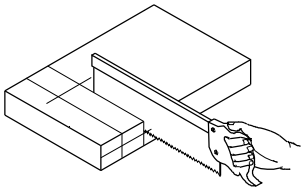
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Fig 1



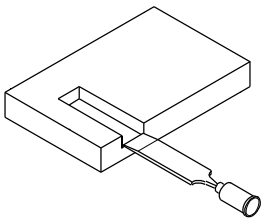
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Fig 2



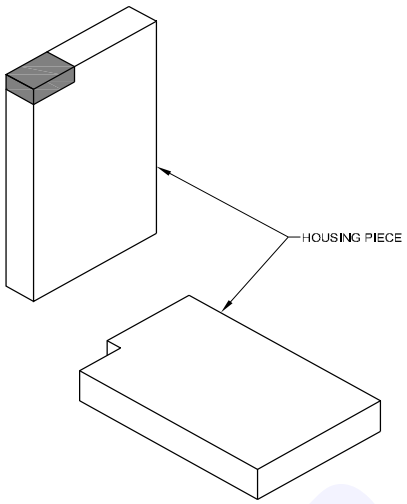
CE20N18110J2

Fig 3



CE20N18110J3

Fig 4



CE20N18110J4

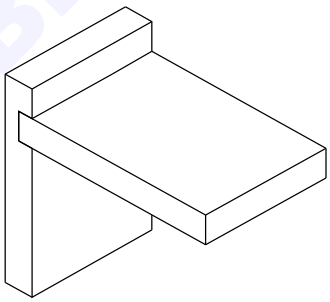
6 Make the shape of shoulder on housed pin piece i.e. 60 x 20 x 10mm as per drawing (Fig 4).

7 Smooth the shoulder of pin and finishing with a firmer chisel.

8 Assemble both the pieces together and finish the job. (Fig 5)

9 Check the squareness of the job using try square.

Fig 5



CE20N18110J5

TASK 3: **Make a bridle joint**

1 Plane the material to the required size as per drawing using jack plane.

2 Measure and mark job as per drawing using scriber, try square and mortise gauge. (Fig 1)

3 Hold the socket pin piece in the vice horizontally and with tenon saw cut the shoulder portion to a depth of 7mm (upto the gauge line) on right and left sides. (Fig 2)

4 Chisel off the waste portion slowly and carefully finish the trench surface on the face side and on its reverse side. Using firmer chisel (Fig 2).

5 Hold the socket piece in the carpenter's vice.

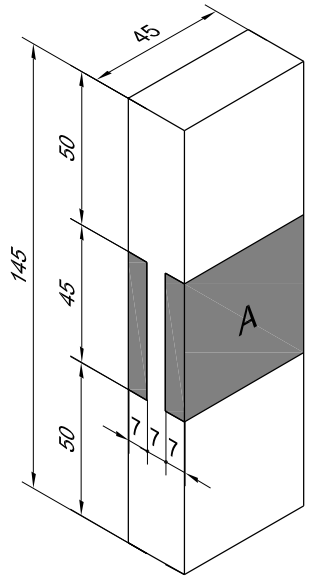
6 Start sawing up to the shoulder line. Saw near to the gauge lines. (Fig 3)

7 Chisel off the waste portions and remove the excess wood and smoothen the socket surface.

8 Assemble the socket pieces with the pin piece by joining it gently.

9 Finish the job using smoothing plane. (Fig 4).

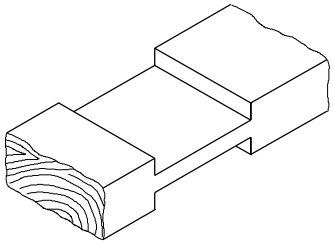
Fig 1



CE20N18110X1

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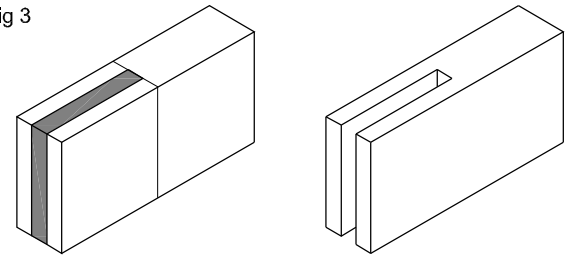
Fig 2



PART "B" OF SOCKET PIN

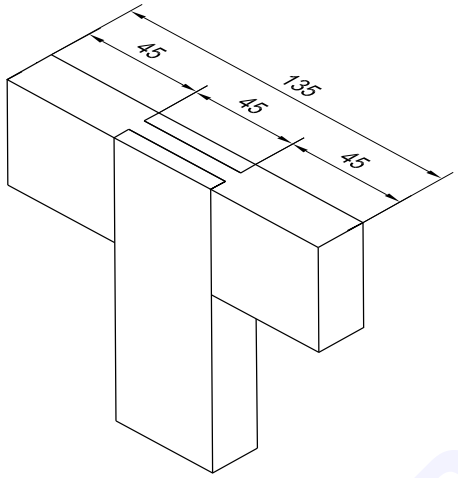
CE20N18110X2

Fig 3



CE20N18110X3

Fig 4



CE20N18110X4

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Simple butt joint and rebate joint

Objective : At the end of this exercise you shall be able to
- **make a simple butt joint and rebate butt joint.**

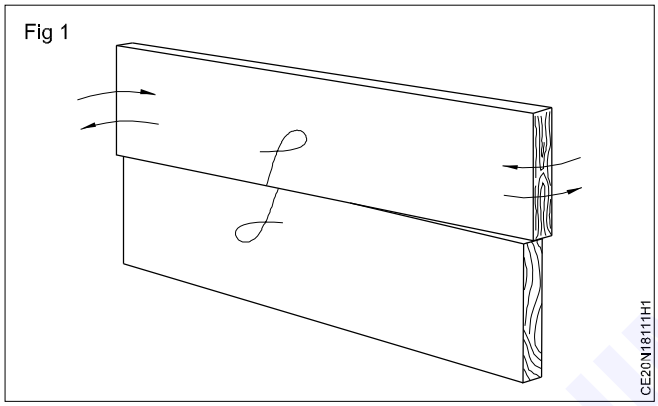
PROCEDURE

TASK 1: **Make a simple butt joint**

1 Plane it to size of 90 x 15 x 450mm - 2 Nos using jack plane and check squareness using try square.

2 Keep one piece over the other and check the alignment. (Fig 1)

Fig 1



3 Hold the straight edge on the back of the two pieces and check the flatness.

4 If not square, plane the higher side of the part and finish it.

5 Hold the two pieces in the vice keeping edge side upward and make parallel to each other.

6 Apply fevicol on the face edges of both the plank uniformly. (Fig 2)

7 Take the upper piece and put it on the bottom piece.

8 Rub it three or four times to squeeze the fevicol into the grains.

9 Keep the two planks pressed in a `T' clamp on both right and left sides. (Fig 3)

10 Allow the fevicol to dry.

Fig 2

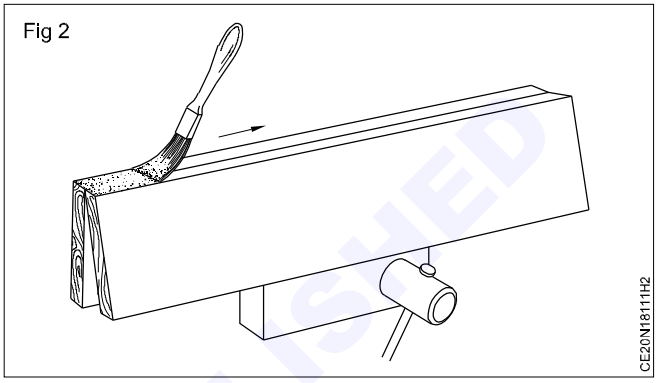
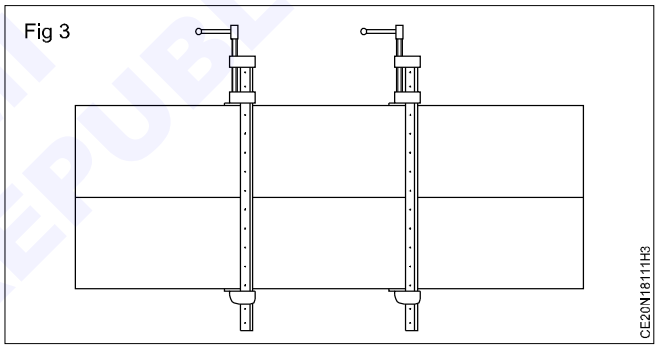


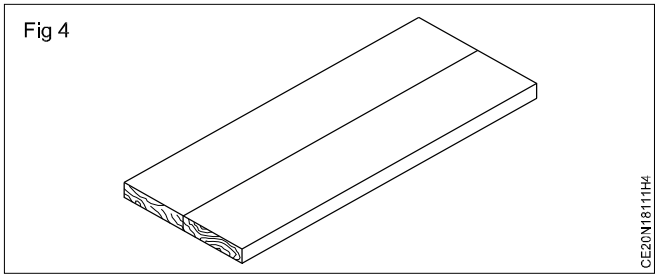
Fig 3



11 Remove the `T' clamp from plank.

12 Finish the surface of the joint using the smoothing plane. (Fig 4)

Fig 4



TASK 2: **Make a rebate butt joint**

1 Plane it to size of 80x20x450 - 2 No's using jack plane.

2 Check the flatness of the face edge, and face side using Try square and straight edge.

3 Hold both the planks side by side in a carpenter's vice (Fig 1).

4 Set the marking gauge for 10mm. Keep the marking gauge against to the face side, scribe the line 10mm on the face edge of first plank. (Fig 1)

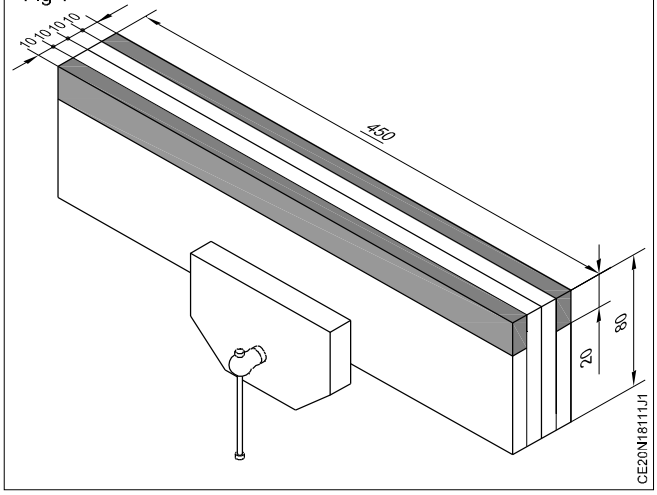
5 Set the marking gauge for 20mm. Similarly keep the marking gauge against to the face edge scribe a line of 20mm width on the face side of first plank.

6 Keep the marking gauge against to face side of the second plank, scribe a line 10mm on the face edge (Fig 1).

7 Keep the marking gauge against to face edge of the second plank, scribe a 20 mm line on the face side.

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Fig 1

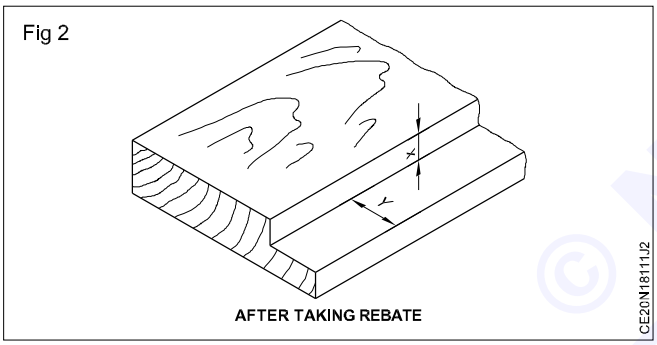


8 Keep the marked plank against the bench stop on the work bench (Fig 2)

9 Plane the planks with the rebate plane with the above settings to make the rebate. (Fig 2)

10 Check its squareness and flatness of the rebate with try square. (Fig 2)

Fig 2



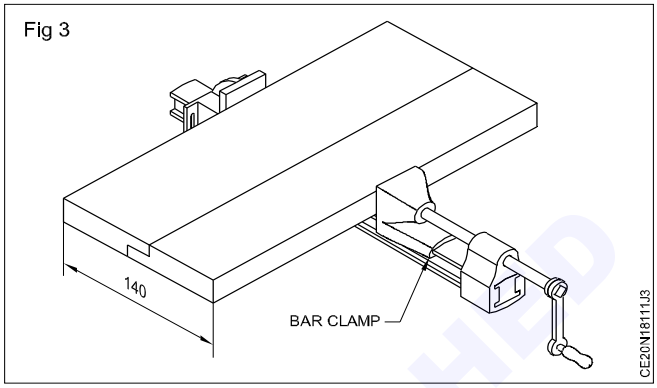
11 Hold the plank flatly and keep the rebate of the second plank just.

12 Keep both the planks together and check its alignment.

13 Apply glue on the rebate part of both the planks and fix both the planks along its rebate. Just move to and fro to spread the glue evenly (Fig 3).

14 Clamp it in a bar clamp and tighten it (Fig 3)

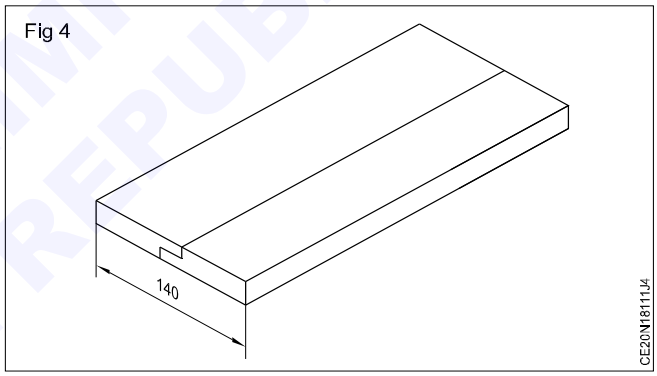
Fig 3



15 Allow glue to dry. Remove the cramp, finish the joint using smoothing plane. (Fig 4)

16 Check the flatness of the job using straight edge. (Fig 4)

Fig 4



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End half lap, end over lap and end bevel lap joint, scarf joint and table scarf joint with wedges

Objective: At the end of this exercise you shall be able to
- **make a end half lap, end over lap, end bevel lap, scarf joint and table scarf joint with wedges.**

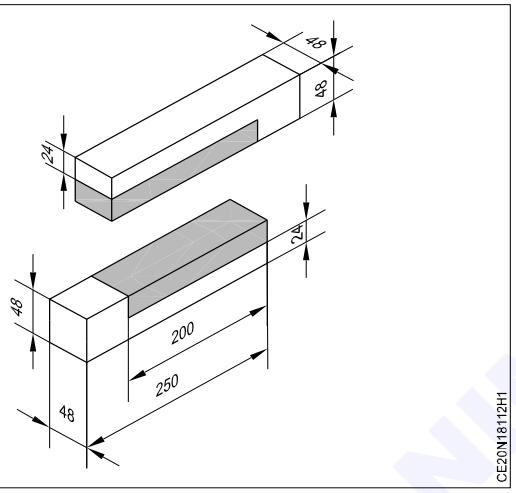
PROCEDURE

TASK 1: **Make a end half lap joint**

1 Plane it to size of 48 X 48 X 250mm = 2 No's.

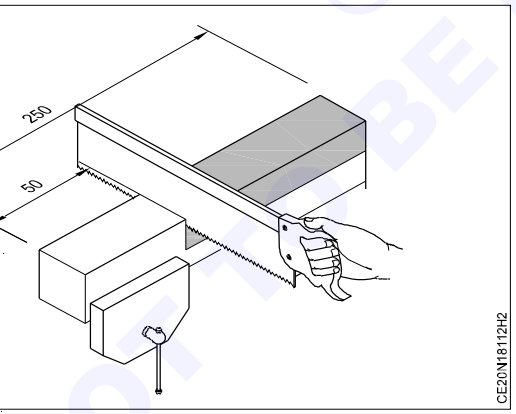
2 Mark the dimension shown in (Fig 1).

Fig 1



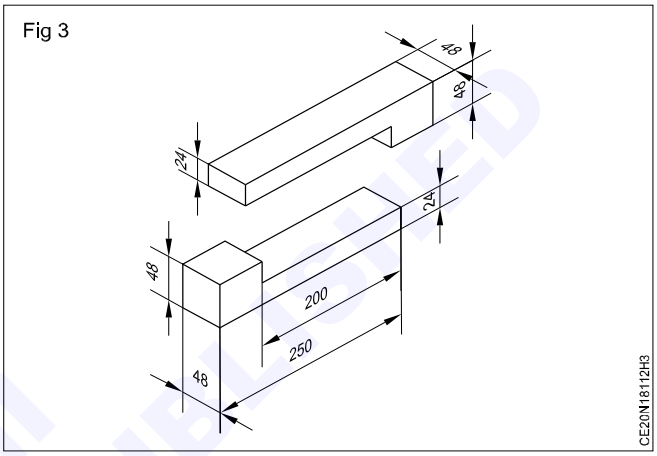
3 Make the half lap both pieces as per the drawing. (Fig 2)

Fig 2



4 Finish the edge using firmer chisel (Fig 3)

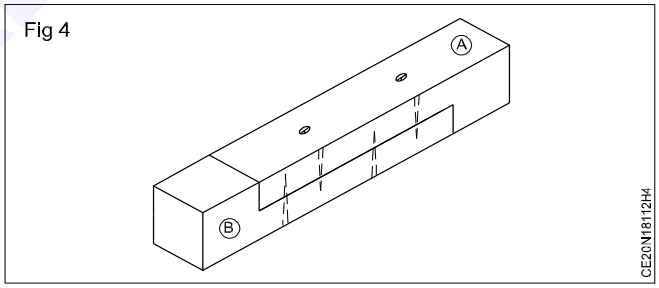
Fig 3



5 Apply glue on half lap and shoulder surfaces of the blocks evenly with a brush.

6 Keep A block over B block and move it front and back for the uniform spread for the glue. (Fig 4)

Fig 4



7 Clamp it if necessary using 'G' clamp.

8 Fix 40x8mm screws drive it to a depth 40mm on both top and bottom surface.

9 Similarly drive the other screw in the job.

10 Allow the glue to dry. Remove the clamp.

11 Finish the surfaces of the job using smoothing plane.\

— — — — — — — —

TASK 2 : **Make a end over lap joint**

1 Plane it to size 140x23x360mm using jack plane.

2 Cut into two pieces of size 140x23x175 using tenon saw.

3 Mark the job as per drawing (Fig 1) using try square.

4 Keep the piece on the work bench.

5 Mark the locations for the nails with marking awl.

6 Apply glue on joining surface.

7 Assemble both the pieces in place and tighten it using 'G clamp'.

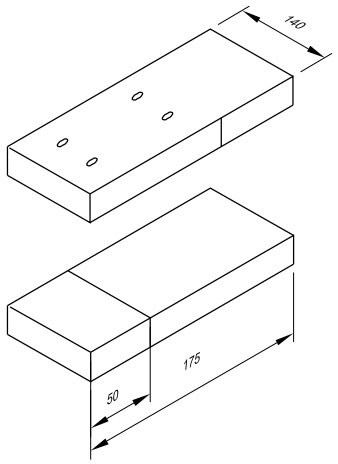
8 Drive the nail through the job using hammer.

9 Allow glue to dry, remove the G. clamp.

10 Finish the joint using smoothing plane. (Fig 2)

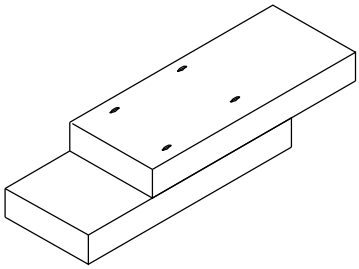
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Fig 1



CE20N18112J1

Fig 2



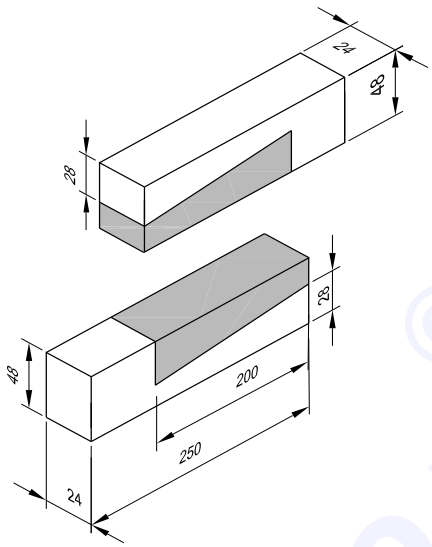
CE20N18112J2

TASK 3 : **Make a end bends or bevel lap joint**

1 Plane it to size of 48x24x250mm =2 No's using jack plane.

2 Mark the job as per the drawing using try square and scriber. (Fig 1)

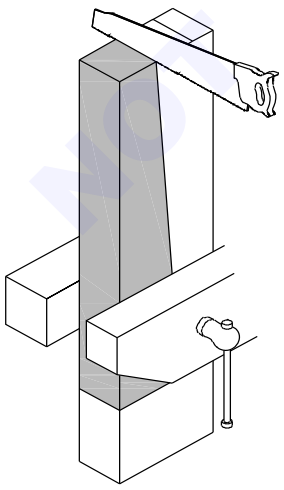
Fig 1



CE20N18112X1

3 Make saw cut across the line using tenon saw. (Fig 2)

Fig 2



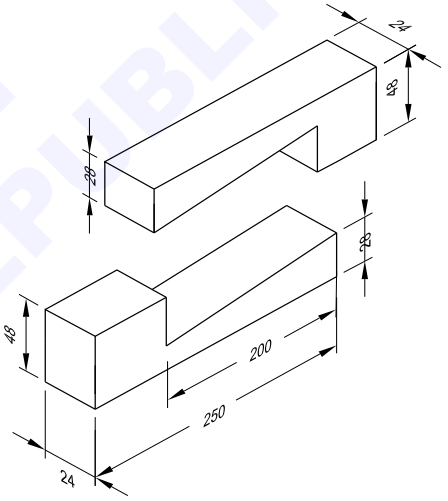
CE20N18112X2

4 Remove the top portion of the piece sawn by the hand saw.

5 Use firmer chisel to smooth the saw-cut part and remove extra material.

6 Repeat the same procedure on the other piece also. (Fig 3)

Fig 3



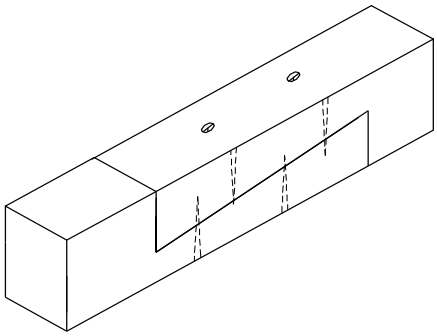
CE20N18112X3

7 Finish the edge using firmer chisel.

8 Mark the position of drill hole on the job.

9 Drill 3mm holes on the marked lines with a hand drill and counter sink it. (Fig 4)

Fig 4



CE20N18112X4

10 Apply glue on joining surfaces.(Fig 4)

11 Assemble both the pieces together and drive the screws on the counter sink holes on both top and bottom surfaces. (Fig 4)

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12 Allow glue to dry.

13 Finish the joint using smoothing plane.

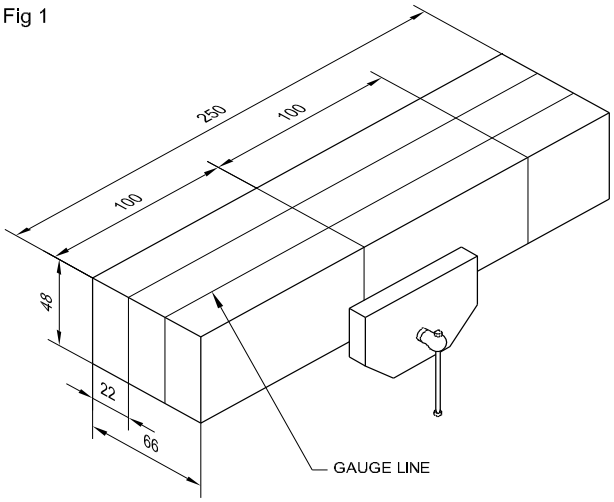
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TASK 4: **Make a scarf joint**

1 Plane it to size of 250 x 66 x 48 = 2 Nos

2 Holding the stock of marking gauge against to the mark the job as per the drawing using foot rule try square and marking gauge, scriber. (Fig 1)

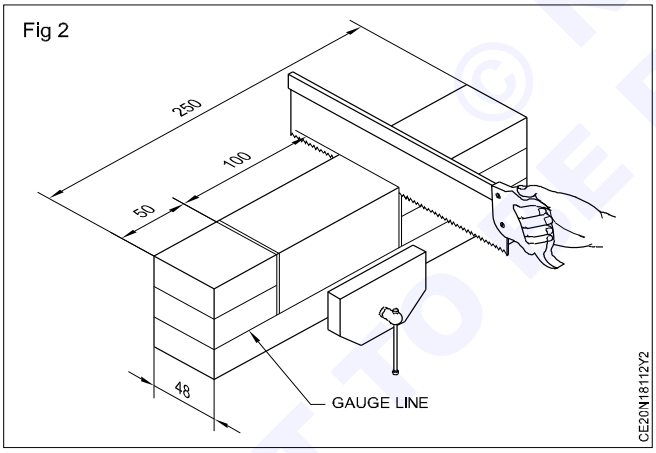
Fig 1



3 Hold the job with face edge upwards in the vice. (Fig 2)

4 Make a saw kerf first close to 50 mm line and 150 mm line from left using tenon saw. (Fig 2)

Fig 2



5 Hold the job vertically and cut off the shaded portion using Hand saw/Tenon saw as shown in (Fig 3).

6 Clean the surface of the saw-cut portion using firmer chisel.

7 Repeat the same procedure for making Part A. (Fig 4)

8 Apply glue on trench and shoulder surfaces of the blocks evenly with a brush.

Fig 3

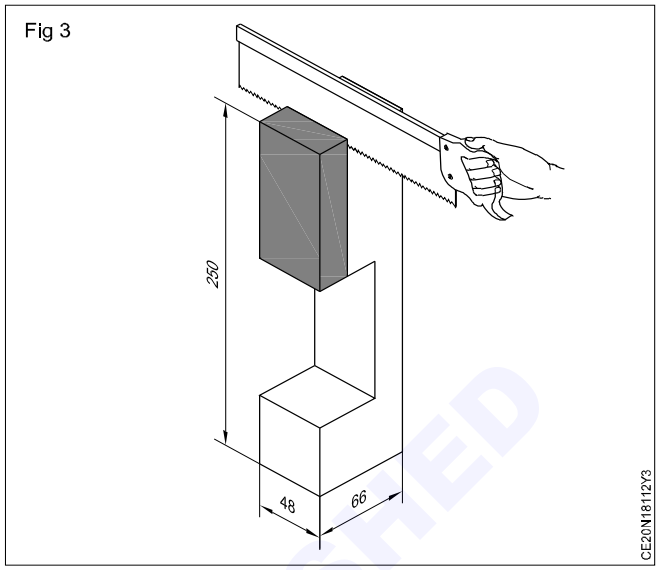
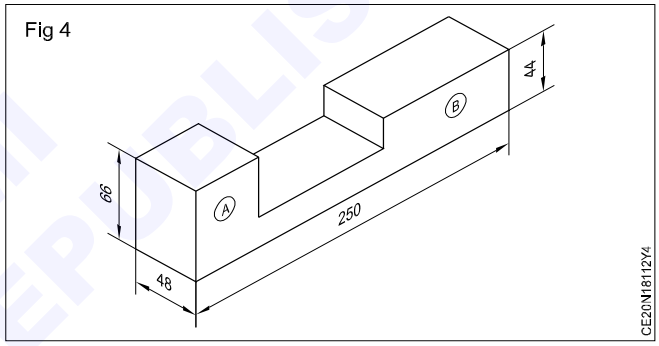


Fig 4

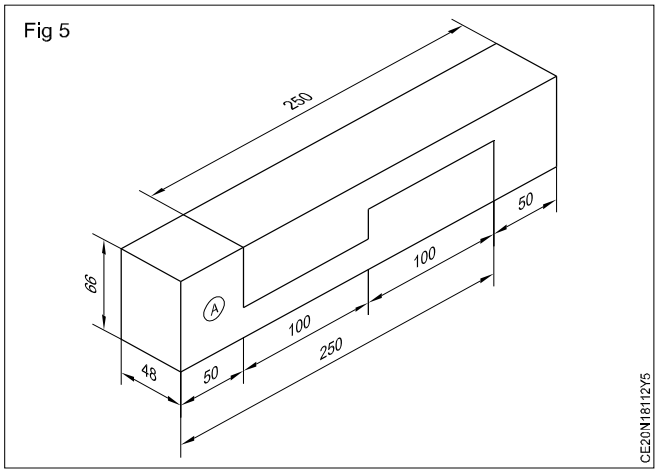


9 Clamp it if necessary using `G'clamp.

10 Allow the glue to dry. Remove the clamp.

11 Finish the surfaces of the job using smoothing plane.(Fig 5)

Fig 5



— — — — — — — —

TASK 5 : **Make a table start joint with wedges**

1 Plane it to size of 60 x 30 x 200 mm 2 NOS - foot using jack plane

2 Mark the job as per the drawing using tool rule, try square, marking gauge and scriber.

3 Make scarf portion using tenon saw, firmer chisel, mortise chisel and mallet (Fig 2 & 3).

4 Mark and make the wedges as per drawing. (Fig 4)

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5 Apply glue on the bottom surfaces of the top part and the top surface of bottom part and assemble it. (Fig 5)

6 After assembling the two pieces, 20mm gap will be seen in the joint.

Fig 1

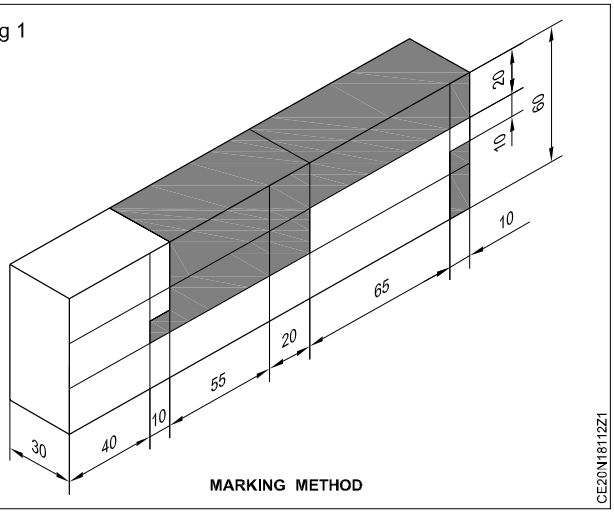


Fig 2

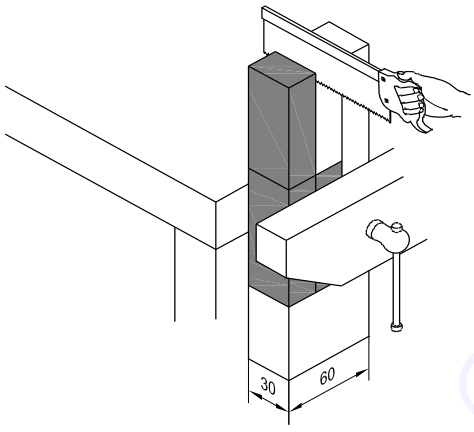


Fig 3

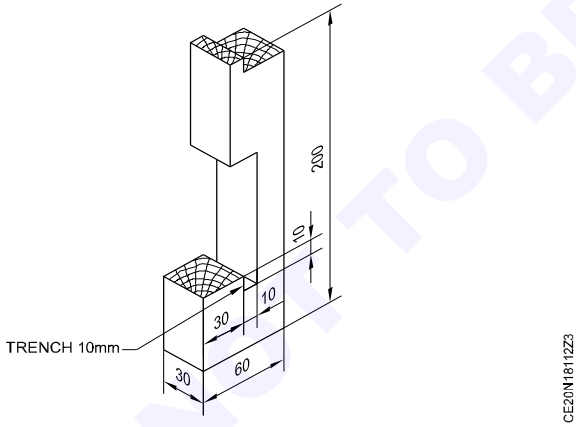


Fig 4

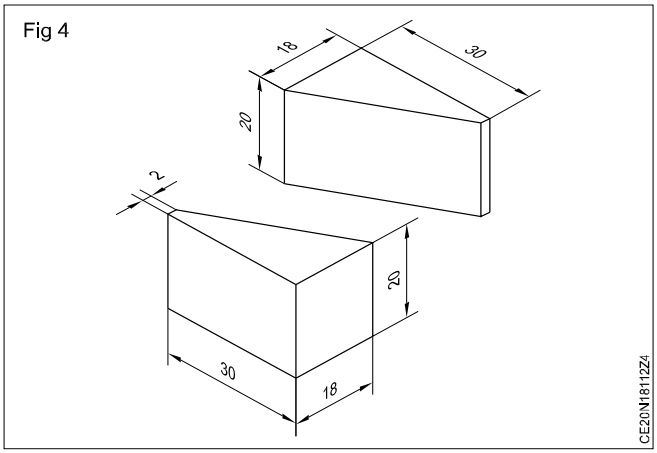
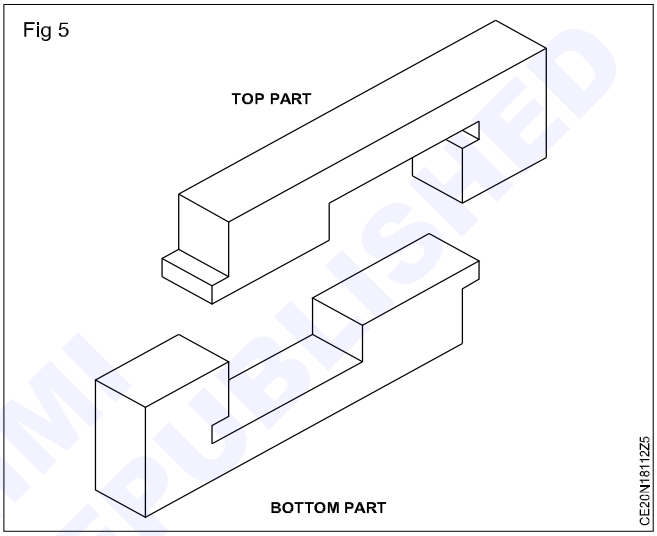


Fig 5

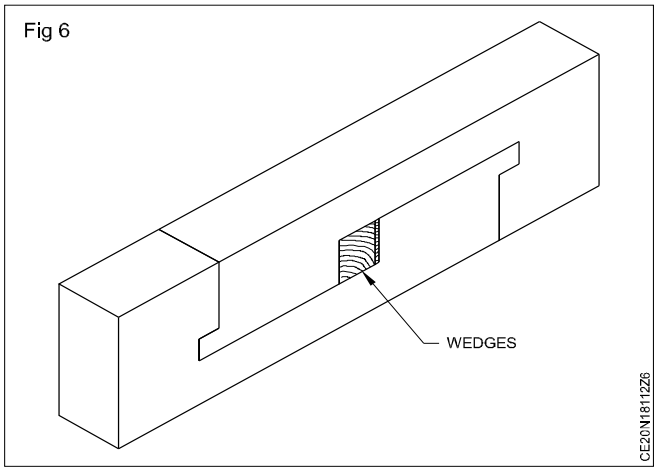


7 Push the wedges in the gap. Push the 18mm width side of the wedge from face side and 2mm width side wedge from the back of the face side.

8 Gently tap the wedge with a mallet and then level it to the surface.

9 Allow the glue to dry. Finish the joint using smoothing plane. (Fig 6)

Fig 6



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Make small wall bracket

Objective : At the end of this exercise you shall be able to
- **make a solves by six pieces with joint**
- **make the half lap dovetail and stopped tenon**
- **make the rebate**
- **assemble and finish the wall bracket.**

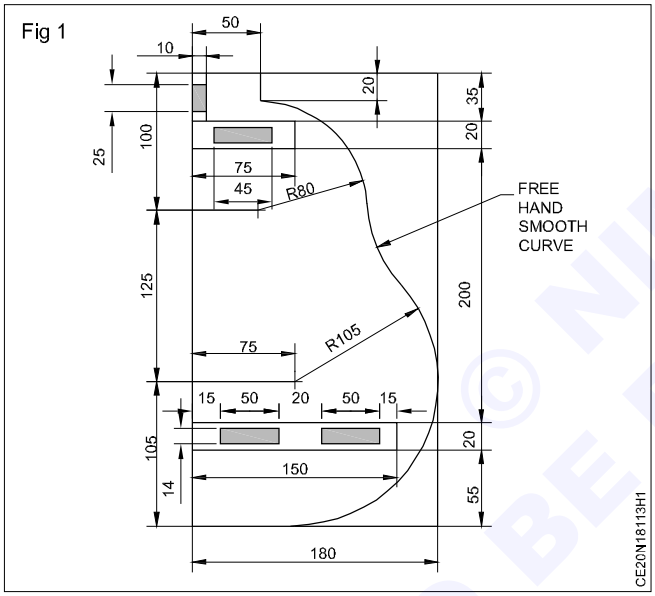
PROCEDURE

TASK 1: **Make a solves by six pieces with joint**

Side pieces

- Plane the pieces to the required width and thickness using jack plane. Size 180x25x330mm = 2 No's
- Mark the dimensions on the surface of the side pieces, the profile as per drawing. (Fig 1)

Fig 1

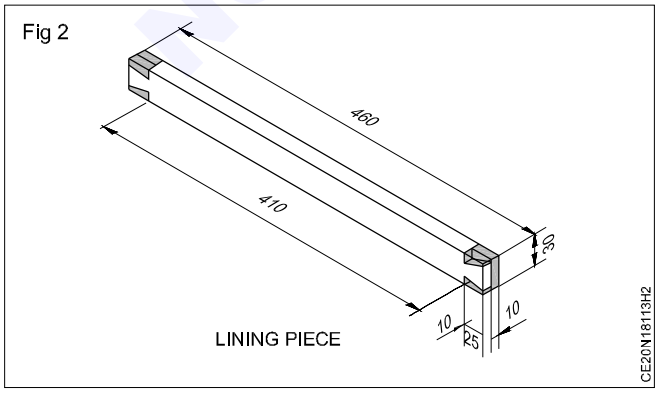


- Make a stopped mortise on two side pieces as per drawing

Lining piece

- Plane the piece to the size 35x20x460mm = 1 No.
- Mark the dimensions of the lining piece profile as per drawing. (Fig 2)

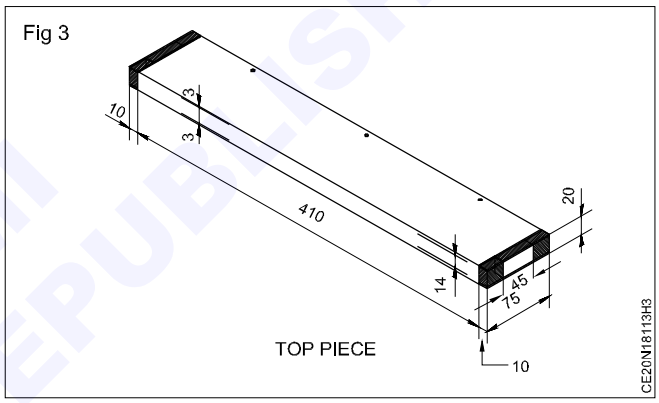
Fig 2



Top piece

- Plane the piece to the required size 75x20x430mm.
- Mark the dimension of the top piece profile as per drawing. (Fig 3)

Fig 3

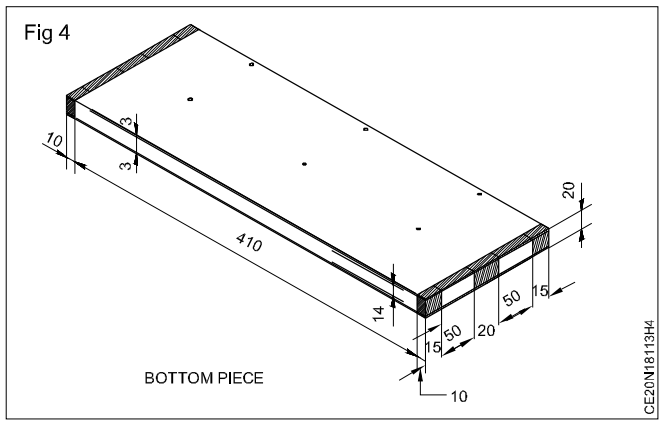


- Make the stopped tenon as per the drawing.

Bottom piece

- Plane the piece to the required size 150x20x430.
- Mark the dimensions of the bottom piece profile as per drawing. (Fig 4)
- Make the stopped as per the drawing
- Make the stopped tenon as per the drawing

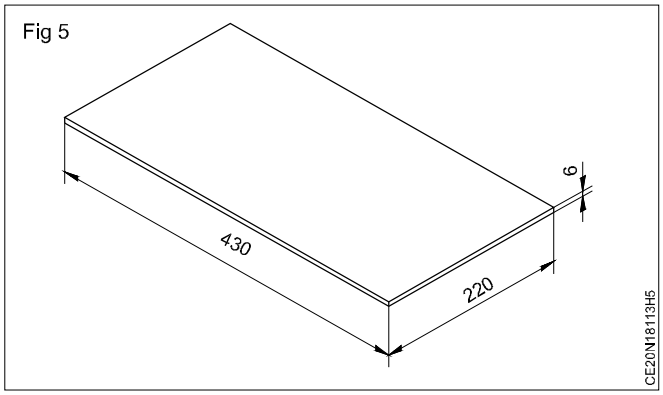
Fig 4



Back piece

- Prepare 430x 220x6mm ply wood as per dimension of the back piece for fixing on the back side of the frame. (Fig 5)

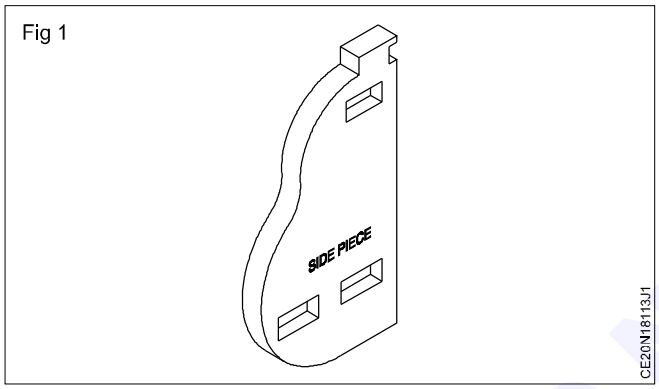
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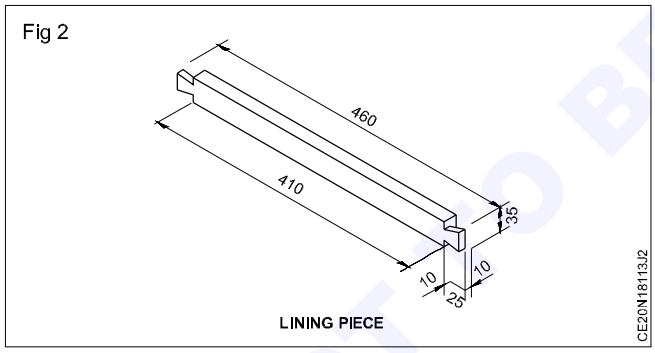
TASK 2 : **Make a half lap dovetail and stopped tenon**

1 Check the marking for the side pieces as per the required measurement.

2 Mark and make the single half lap dovetail socket on the side pieces top as per the drawing. (Fig 1)



3 Mark and make single half lap dovetail pin of the lining piece per the drawing. (Fig 2)



4 Mark and make a rebate on back side of the frame pieces to fix the ply wood.

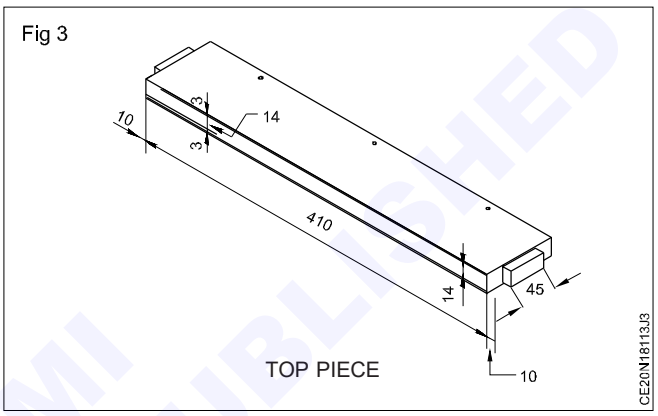
5 Make the stopped tenon for the top piece as per the drawing (Fig 3)

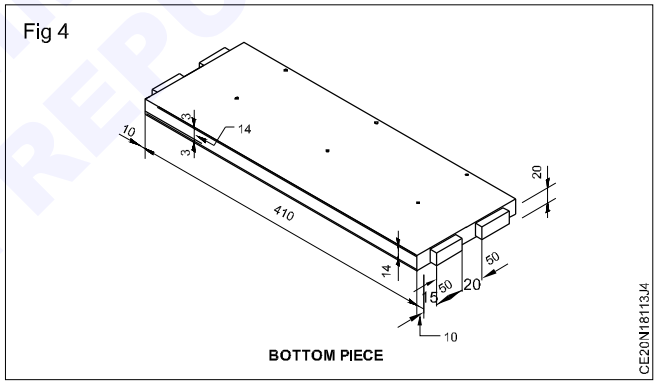
6 Make the stopped tenon for the bottom piece as the per the drawing (Fig 4)

Assembling and finishing

1 Apply the glue on the shelves by six pieces on the surface stopped mortise, tenon and single half lap dovetail socket and pin using brush. (Fig 1 - 4)

2 Assemble the pieces together using mallet/hammer. (Fig 1,2,3 & 4)





3 Place the wall bracket over bar clamp and tighten it.

4 Drill a hole on the marked point of the drill hole using power drilling machine.

5 Screw the side together using 35mm screw.

6 Drive the screws so that screw head should sit properly in the counter sink holes.

8 Screw the lining piece on top of the side pieces with 35 mm screw using screw driver.

9 Fix the 6mm ply wood on rebate surface of the frame using 20 mm wire nail. (Fig 5)

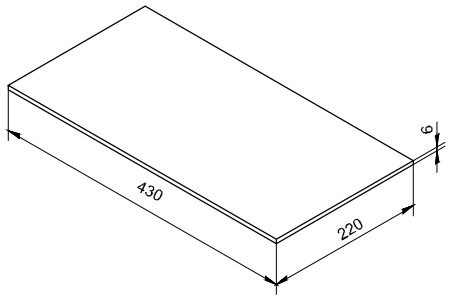
10 Check the squareness of the job.

11 Smooth the surface of the wall bracket using sand paper No 60, 120, 150

12 Finish the small wall bracket. (Fig 6)

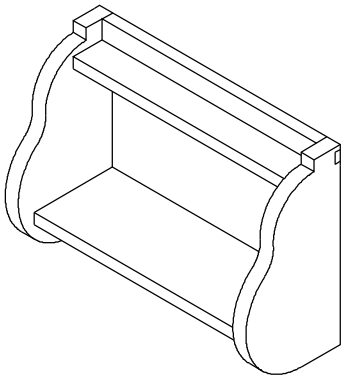
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Fig 5



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Fig 6



SMALL WALL BRACKET

CE20N18113J6

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Make different types doors including paneled, glazed door

Objectives: At the end of this exercise you shall be able to
- **make single panel door and a glazed door shutter.**

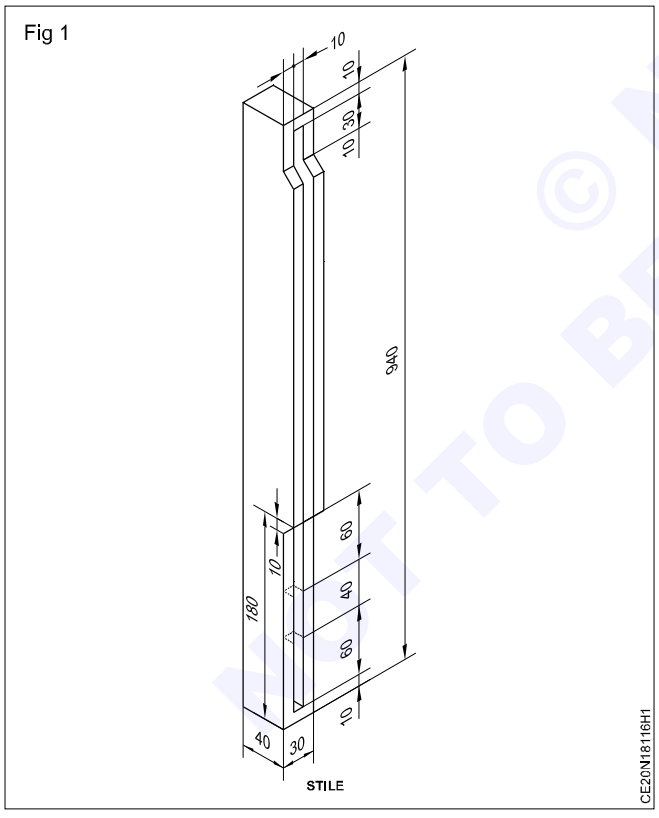
PROCEDURE

Instructor shall display and demonstrate to the students regarding the doors in the section and brief their types and uses.

TASK 1: **Marking single panel door shutter**

- Plane the wooden pieces to the required size using jack plane, try square and marking gauge.
  - a Stiles 50 x 30 x 940 - 2 Nos.
  - b Top rail - 50 x 30 x 530 - 1 No.
  - c Bottom cross rail - 180 x 30 x 530 - 1 No.
  - d Panel plank - 450 x 24 x 740 - 1 No.
- Mark and make the total length on all pieces as per drawing.
- Mark and make through the haunched mortise on top of the stiles as per drawing. (Fig 1)

Fig 1



- Mark and make double through haunched mortise on the bottom end of the stiles as per drawing.(Fig 1)
- Mark and make haunched tenon on both the ends of the top rail as per drawing. (Fig 2)
- Mark and make the double through haunched tenon on both the ends of the bottom rail as per drawing. (Fig 3)

Fig 2

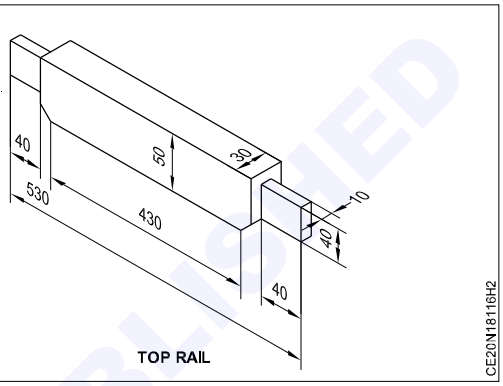
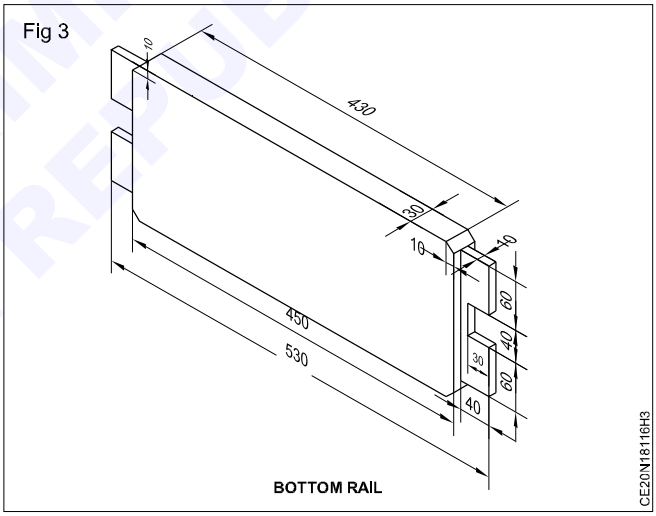


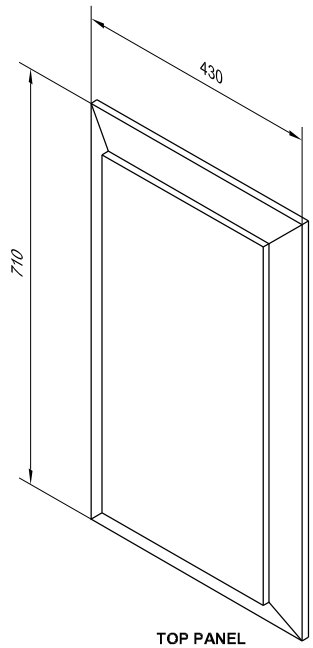
Fig 3



- Mark and make the groove on stiles, rails pieces as per drawing. (Figs 1 to 3)
- Mark and make the bevels on panel piece of the door as the drawing. (Fig 4)
- Check the required dimension of mortise, tenon, groove and panel on respective pieces before assembling.
- Prepare the wooden pegs.
- Mark the drill hole position on stiles and rails.
- Apply the glue on mortise and tenon surfaces and assemble the stiles, rails and panel with their respective pieces for correct assembling.
- Clamp the pieces together using bar cramp on top cross rail and stiles of the frame.
- Drill the holes at the centre of the mortise and tenon joint.

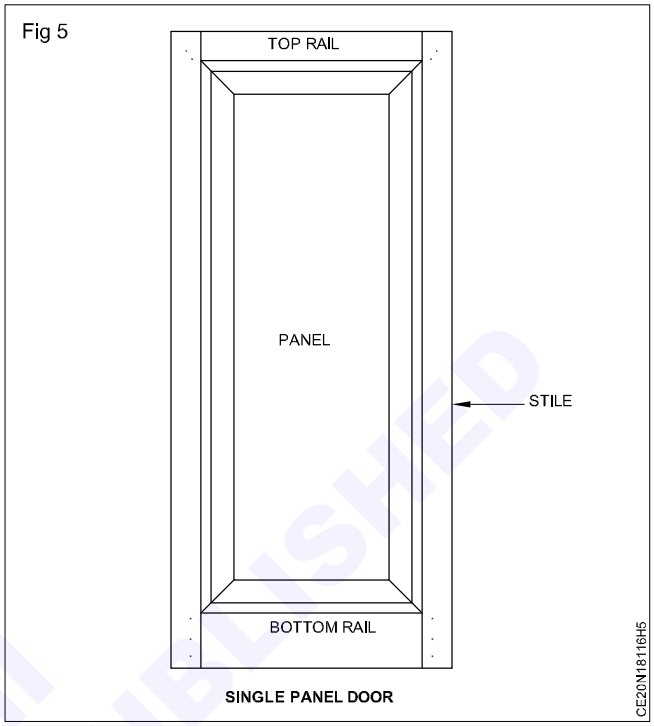
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Fig 4



- Insert the wooden peg in drilled hole of the frame.
- Repeat the same procedure on all other mortise and tenon joints also.
- Cut of the projected wooden pegs using hand saw.
- Remove the bar clamp.
- Finish the doors shutter using jack smoothing plane. (Fig 5)

Fig 5



TASK 2: **Marking glazed door shutter**

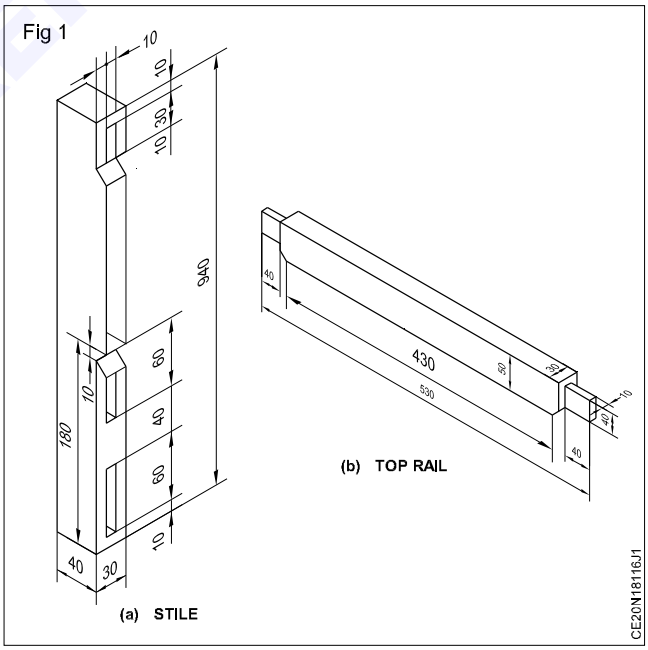
- Plane the wooden pieces the required size

  Stiles 50 x 30 x 940 mm - 2 Nos.

  Top rail - 50 x 30 x 530 mm - 1 No.

  Bottom rail - 180 x 30 x 530 mm - 1 No.
- Mark and make the total length on both the stiles, top and bottom members as per drawing..
- Mark and make the haunched mortise on both top and bottom stiles ends as per drawing. (Fig 1 a)
- Mark and make the haunched tenon on both the ends of the top rail as per drawing. (Fig 1 b)
- Mark and make the haunched tenon (double) on both ends of the bottom rail as per drawing. (Fig 2)
- Mark and make the rebate on vertical stiles, top and bottom rails as per drawing.
- Check all the pieces for the required dimension and proper shapes before assembling.
- Prepare a suitable wooden peg to fixing.
- Mark the drill hole position on stiles.
- Apply the glue on mortise and tenon surface for assembling door shutter frame.
- Assemble the pieces together respective fitment places.
- Clamp the assembled frame together using bar clamp on top cross rail and stiles.

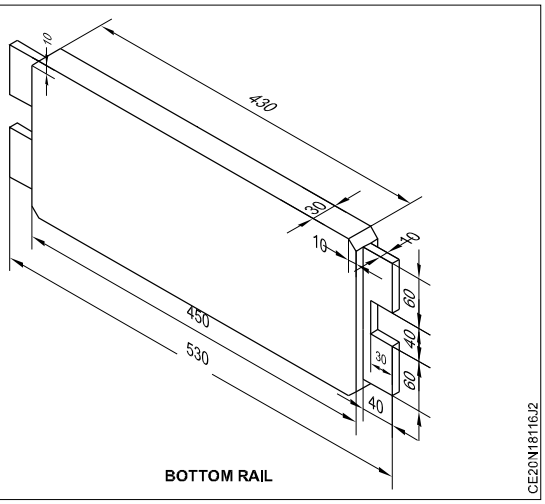
Fig 1



- Drill the holes at the centre of the mortise and tenon joint.
- Insert the wooden peg in drilled hole of the frame.
- Repeat the same procedure on other mortise and tenon joints also.
- Cut off the projected wooden pegs using tenon saw.
- Finish the door frame using smoothing plane as per drawing.

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Fig 2



- Check the glass for the required size.
- Prepare the glass for the required door frame size as per drawing and using glass cutter 740x450 (Fig 3)
- Prepare the wooden beading as required.
- Fix the glass on rebate surface with wooden beading using panel pin with task hammer.
- Finish the glazed shutter using smoothing plane as per drawing. (Fig 4)

Fig 3

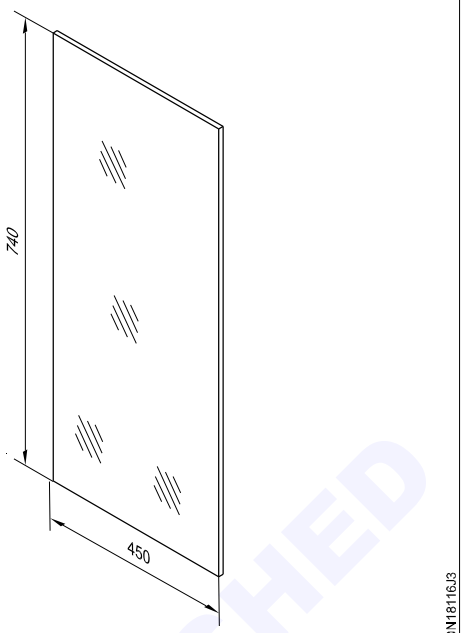
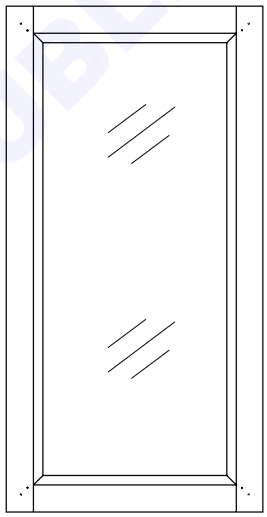


Fig 4



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Make window frame and window shutter

Objectives: At the end of this exercise you shall be able to
- **make window frame and shutter.**

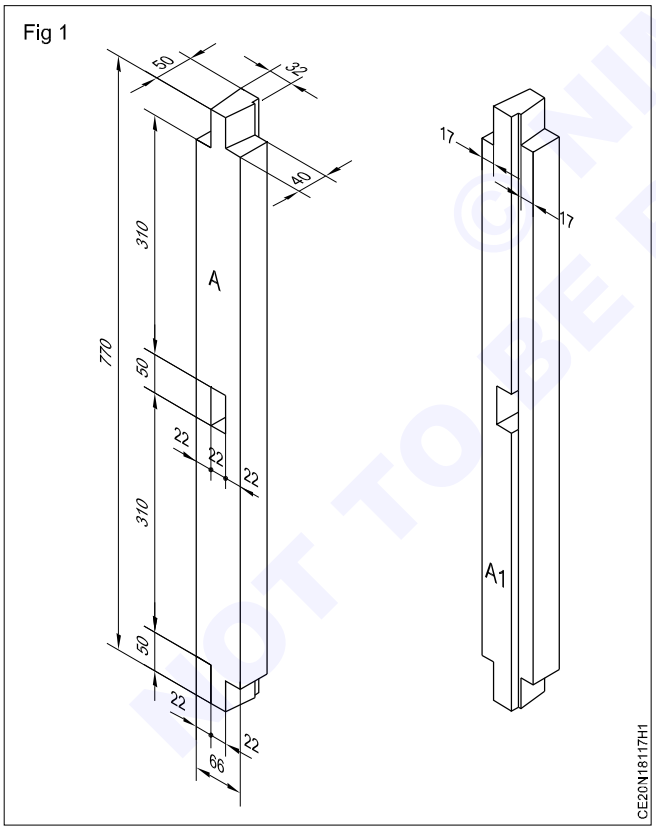
PROCEDURE

Instructor shall display and demonstrate to the students regarding the windows and ventilator in the section and brief their types and uses.

TASK 1: **Make window frame**

- Plane the width and thickness of window frame as per the required dimensions using jack plane and try square.
- Mark and make the total length on both the vertical stiles. (A-A1) as per the drawing using wooden rule and try square. (Fig 1)
- Mark and make the dove tail pin on top and bottom ends of the vertical stiles. as per drawing.
- Mark and make through mortise on middle of the vertical stiles (A, A1) as per drawing. (Fig 1)

Fig 1



- Mark and make the total length and make dove tail socket on top of the cross rail B1 as per drawing. (Fig 2)
- Mark and make the total length and make tenon on both ends on middle cross rail (B2) as per drawing. (Fig 3)

Fig 2

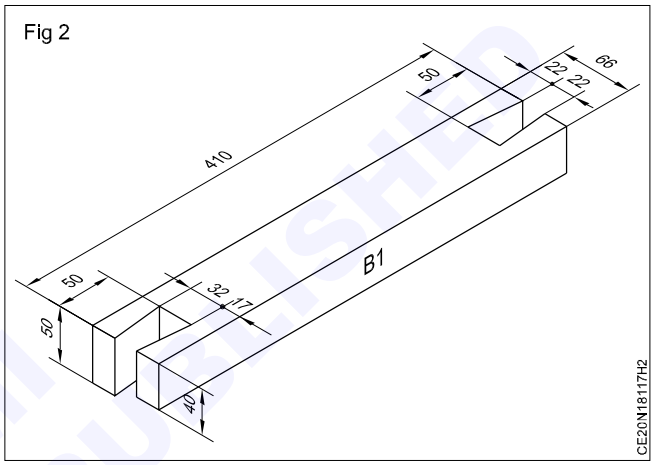
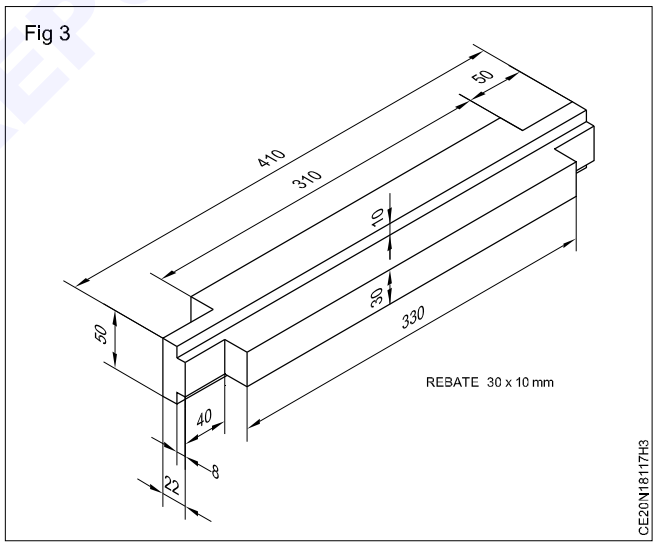


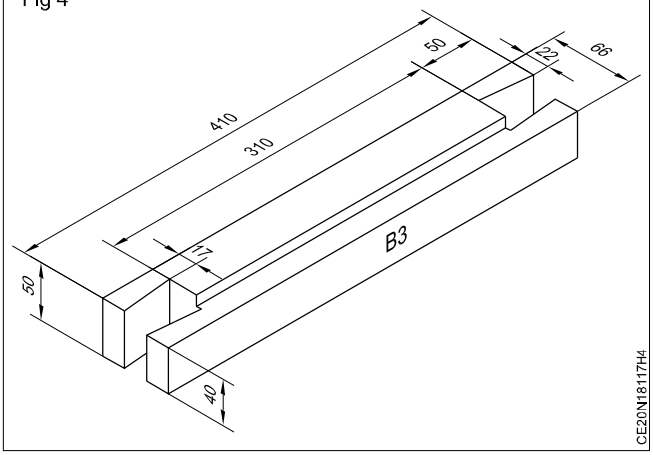
Fig 3



- Mark and make the total length and make dove tail socket of bottom cross rail (B3) as per drawing. (Fig 4)
- Make a rebate surface on a ,A, A1, B1, B2, B3 and pieces as per drawing.
- Check all the pieces for the required dimensions and proper shape as per drawing before assembling.
- Prepare the suitable wooden peg for fixing the frame.
- Apply glue on dovetail pin, dovetail socket, mortise and tenon surfaces.
- Assemble the pieces together to their respective fitment places.

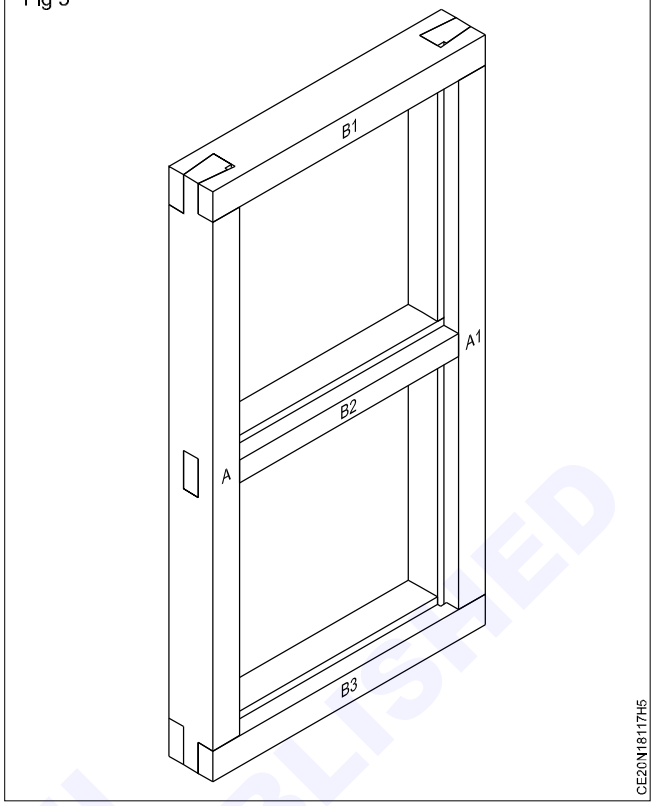
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Fig 4



- Clamp the assembled window frame squarely using bar clamp (at top cross rail)
- Mark and make a drill hole on the centre of dove tail pin and socket joint. (Fig 5)
- Insert wooden peg in drilled hole of the window frame properly.
- Cut off the excess projected peg using hand saw.
- Finish the assembled frame using smoothing plane. (Fig 5)

Fig 5

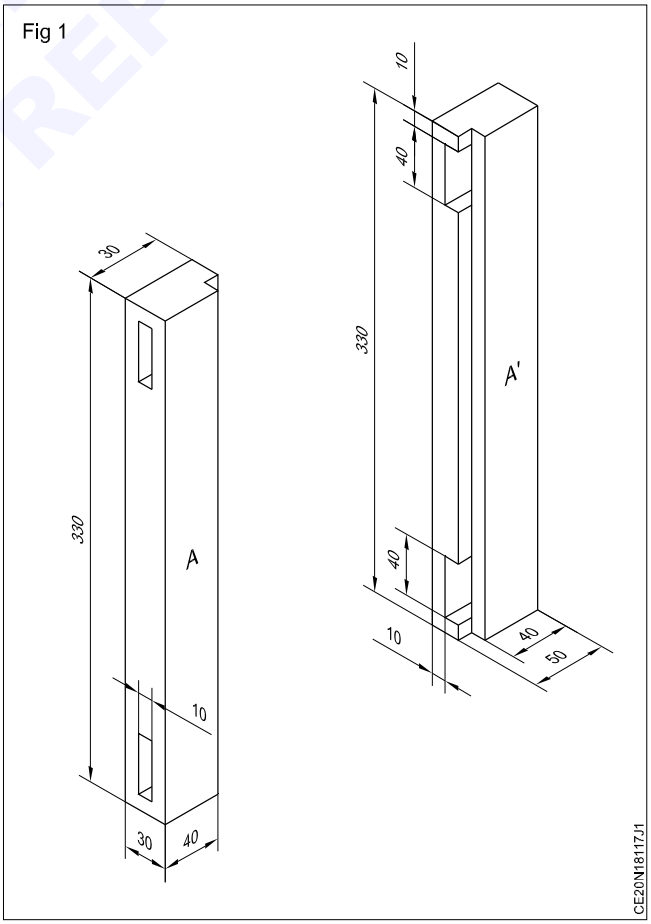


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TASK 2: **Make window shutter**

- Check the length and squareness of planed pieces using try square and steel rule.
- Mark and make the total length on both the vertical stiles A, A1 as per drawing. (for glass) (Fig 1)
- Mark and make the haunched mortise on both the top and bottom ends of the vertical stiles (A, A1) as per drawing (for glass). (Fig 1)
- Mark and make the haunched tenon on both the ends of the top cross rail (B) bottom cross rail (B1) as per drawing (for glass). (Fig 2)
- Mark and make the rebate on vertical stiles (A, A1) top cross rail (B) and bottom cross rail (B1) as per the drawing (for glass). (Figs 1 - 3)
- Mark and make the total length on both the vertical stiles. (D, D1) as per drawing. (for panel). (Fig 4)
- Mark and make the haunched mortise on both the top ends of the vertical stiles (D, D1) as per drawing (for panel). (Fig 4)
- Mark and make the haunched mortise on both the top and bottom ends of the vertical stiles (D, D1) as per drawing (for panel). (Fig 4)
- Mark and make the haunched tenon on both the ends of the top cross rail (C) bottom cross rail (C 1) as per drawing (for panel). (Fig 5 & 6)
- Mark and make the groove on vertical stiles (D-D1) top cross rail (C) and bottom cross rail (C1) as per drawing (for panel). (Figs 4 - 6)

Fig 1



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Fig 2

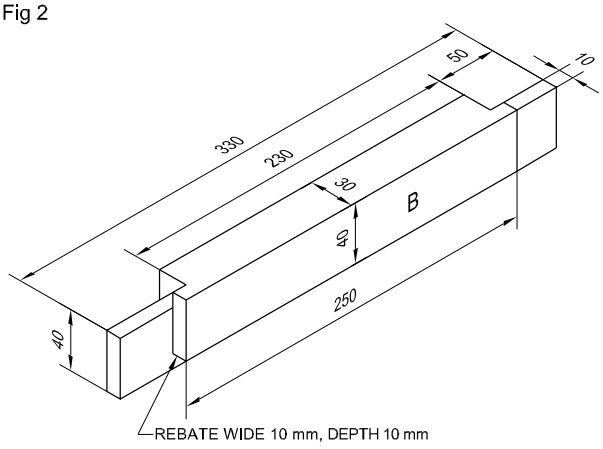


Fig 3

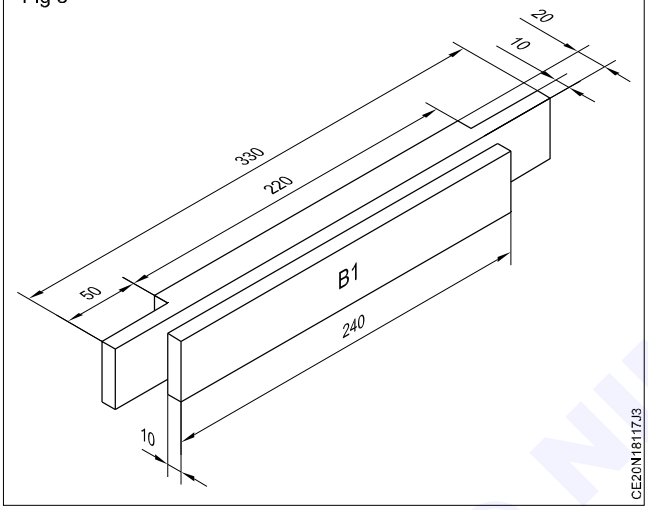


Fig 4

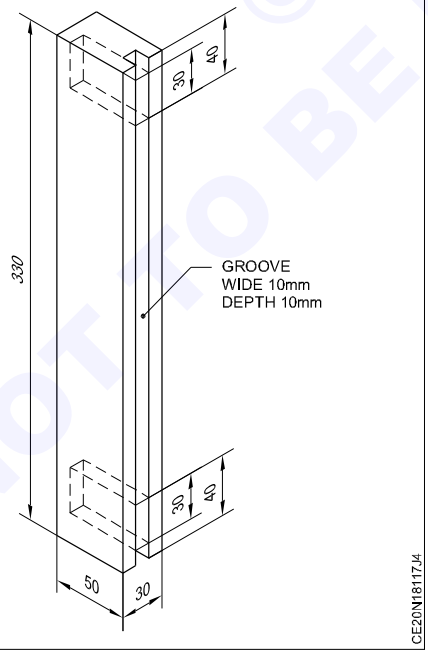


Fig 5

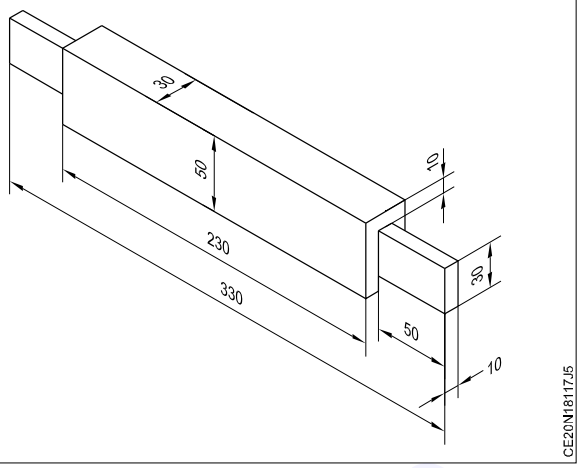


Fig 6

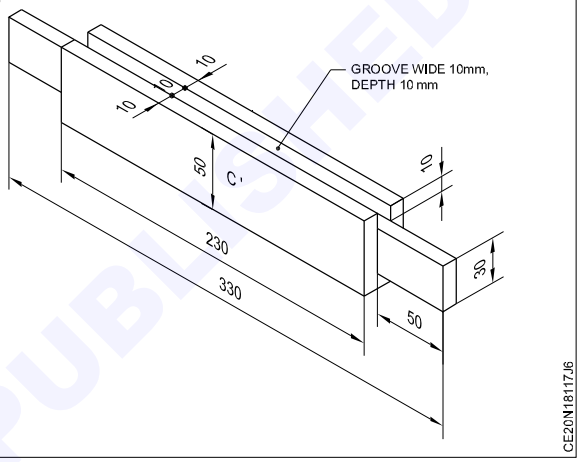
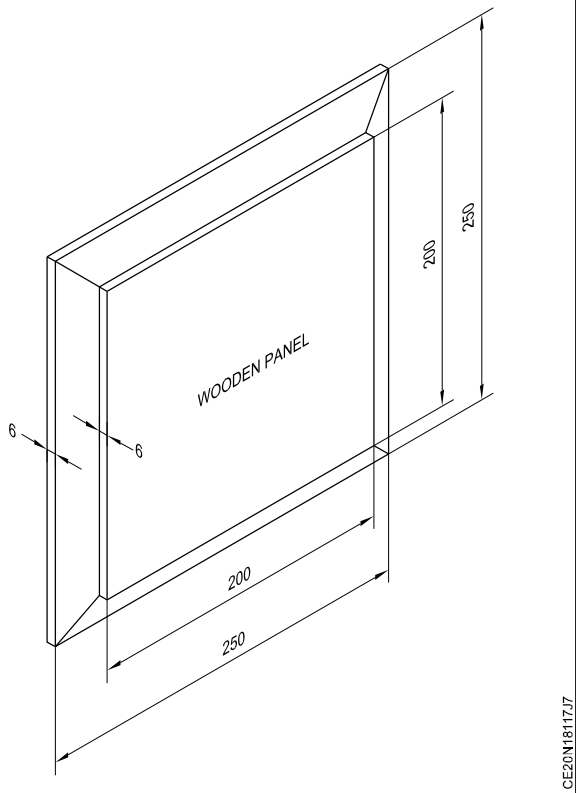


Fig 7



- Prepare the panel piece for the required size as per drawing (E). (Fig 7)
- Check all the pieces for the required dimension and proper shapes before assembling.
- Prepare a suitable wooden peg for fixing.
- Apply the glue on mortise and tenon surfaces for assembling (for panel) and glass.

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Fig 8

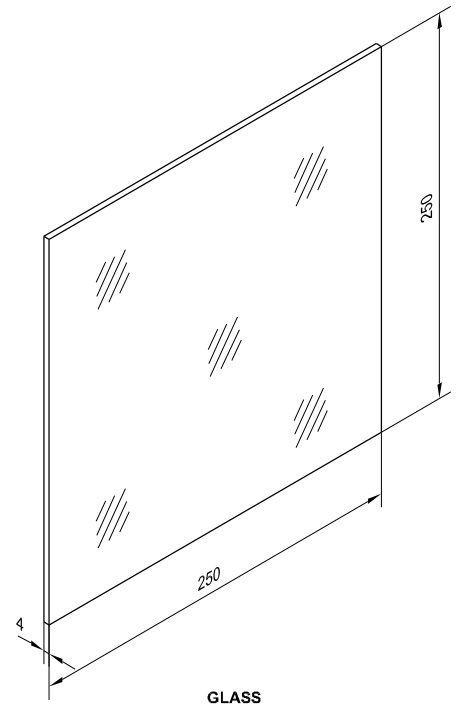
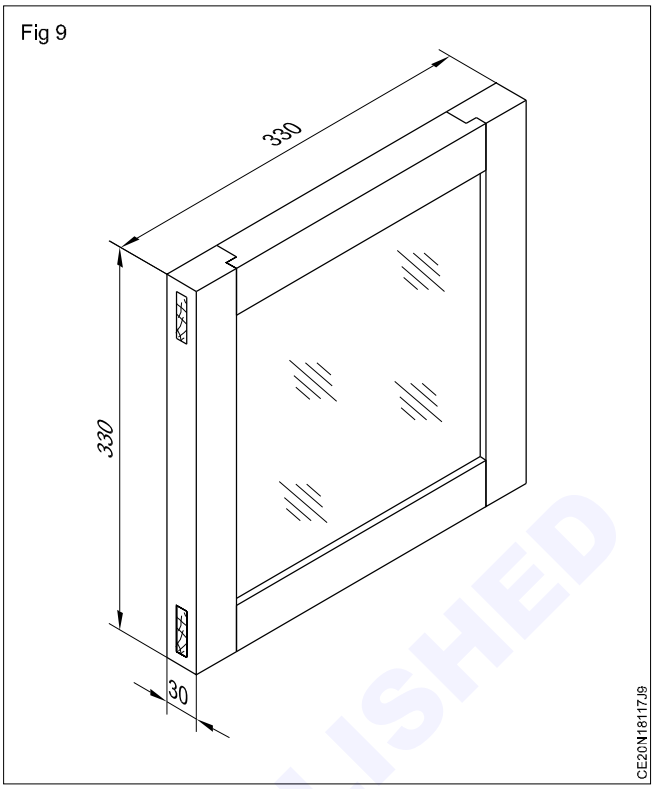
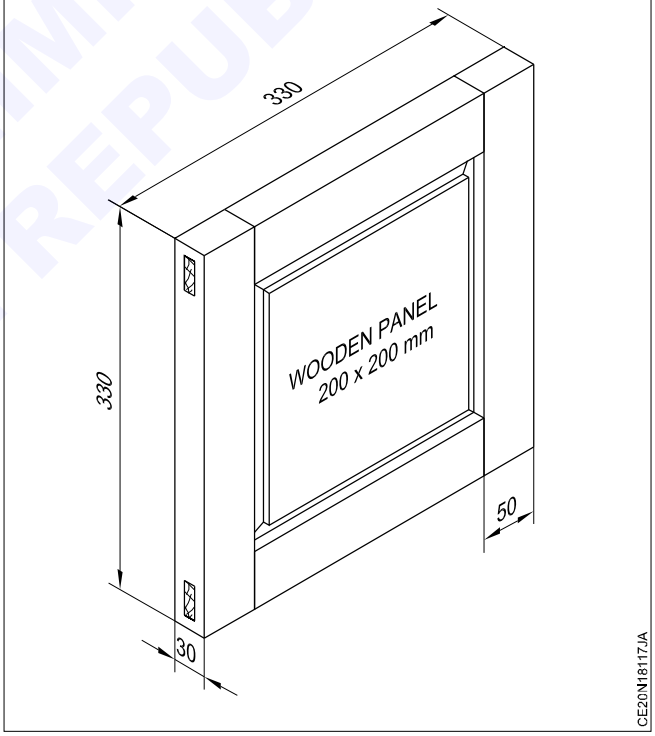


Fig 9



- Assemble the pieces together to their respective fitment places.
- Clamp the assembled frame to squarely.
- Mark and make a drill hole on the center of the mortise and tenon joints.
- Insert the prepared wooden peg tightly on drilled hole.
- Finish the frame using smoothing plane.
- Prepare the glass for the required size. (Fig 9 & 10)
- Prepare the beading as required.
- Fix the glass on rebate surface with beading using panel pin. (Fig 9)
- Finish the window shutter using smoothing plane. (Fig 9)

Fig 10



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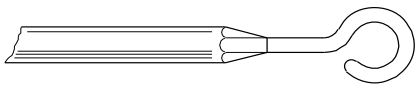
Prepare terminations of cable ends

Objectives: At the end of this exercise you shall be able to
- **prepare termination of cable ends.**

PROCEDURE

TASK 1: **Preparation of loop termination (Solid conductor) (Fig 1)**

Fig 1



LOOP IN SOLID CONDUCTOR

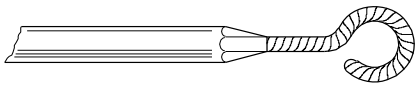
CE20N19118H1

1 Collect a single conductor cable of 1.5 sq.mm (copper) about 250 to 300 mm long from scrap.

2 Mark on the insulation the length 'L' from the cable end. The length 'L' is five times the diameter of the terminal screw.

3 Loop in fine multistrand conductor. (Fig 2)

Fig 2

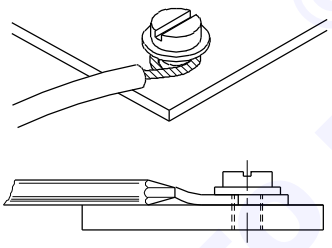


LOOP IN FINE MULTI-STRAND CONDUCTOR

CE20N19118H2

4 Make termination in screw on terminal. (Fig 3)

Fig 3

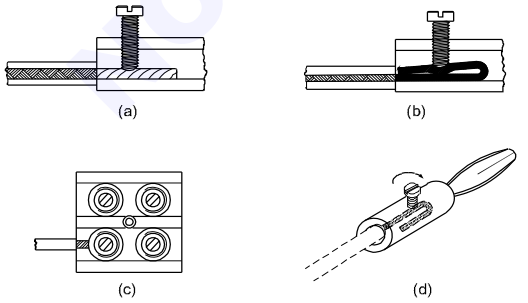


TERMINATION IN SCREW ON TERMINAL

CE20N19118H3

5 Connect the terminated cable in different types of connectors. (Fig 4 a, b, c, d).

Fig 4

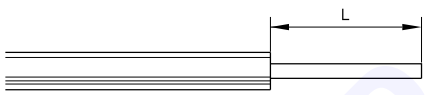


CE20N19118H4

6 Skin the insulation over the length 'L'. (Fig 5)

7 Grip the bare conductor with the round nose pliers as shown in Fig 6.

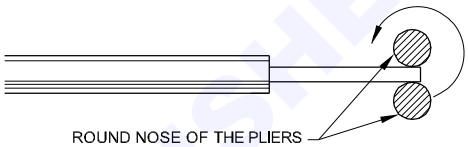
Fig 5



MAKING A LOOP IN THE WIRE

CE20N19118H5

Fig 6



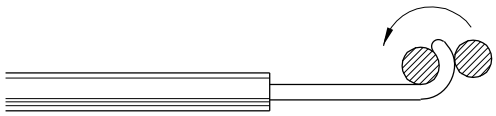
MAKING A LOOP IN THE WIRE

CE20N19118H6

The diameter of the jaw at the gripping point of the round nose pliers is little more than the terminal screw diameter.

8 Turn the firmly gripped nose pliers to form the required loop. (Fig 7)

Fig 7

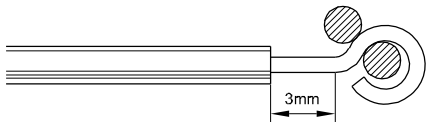


MAKING A LOOP IN THE WIRE

CE20N19118H7

9 Finally set the loops with the nose pliers as shown in Fig 8.

Fig 8



MAKING A LOOP IN THE WIRE

CE20N19118H8

The hook (loop) should go at least about three quarters of the way around the screw.

Check the inner diameter of the loop with the terminal screw.

Never make the hook long as the conductor may overlap.

Keep the length of the exposed conductor to the minimum, not more than 3 mm, to prevent accidental contact with other wires. (Fig 8)

10 Repeat the task for 2.5 sq.mm copper single conductor cable.

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11 Repeat the task for aluminium cable single conductor of 1.5 sq. mm and 2.5 sq. mm.

12 Repeat the task for bare copper wire of 10 SWG and other available sizes.

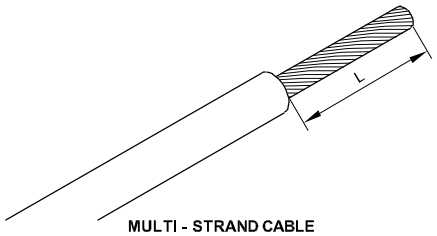
Preparing a fine multistrand cable end for termination to screw-on terminal of terminal blocks

13 Collect a piece of fine multistrand flexible copper cable, of size 14/0.2 mm.

14 Mark the length 'L' from the end of cable. Length 'L' is equal to five times the diameter of the terminal screw.

15 Remove the insulation to the length 'L' (Fig 9) using a pair of wire stripping pliers.

Fig 9

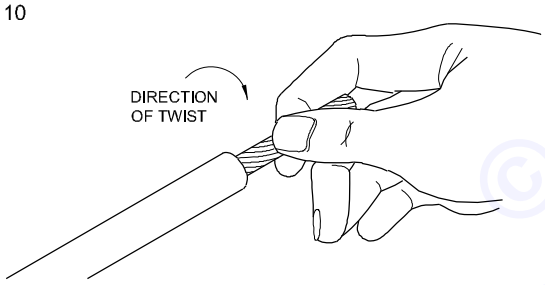


MULTI - STRAND CABLE

CE20N19118H9

16 Retwist the bared strands in the same direction with your fingers. (Fig 10) Note, that the strands are twisted in the wire in a certain direction.

Fig 10



TWISTING THE MULTI-STRAND CABLE CORE

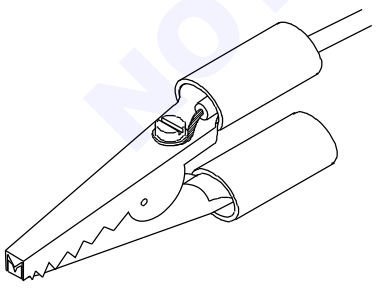
CE20N19118HA

17 Repeat the steps No.4 to No.6 stated for solid conductor to finalise the termination.

18 Repeat the task with other sizes of cables.

19 Repeat the task for terminating flexible cable end on crocodile clips. (Fig 11)

Fig 11

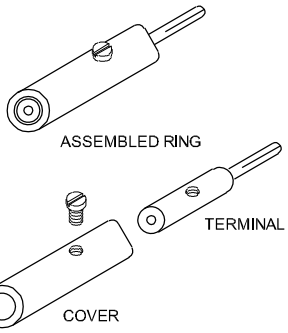


CE20N19118HB

Prepare termination in a fine multistrand cable for single pole plug.

20 Open the given single pole plug. (Fig 12)

Fig 12

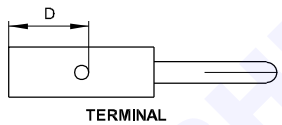


SINGLE POLE PLUG

CE20N19118HC

21 Measure with a steel rule the distance 'D' between the outer edge of the terminal screw hole and the edge of the terminal. (Fig 13)

Fig 13



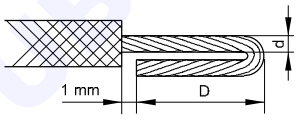
TERMINAL

CE20N19118HD

22 Remove insulation to the length equal to (2D + 1) mm.

23 Bend a loop at the end of the wire to the required dimensions, with your fingers. (Fig 14)

Fig 14

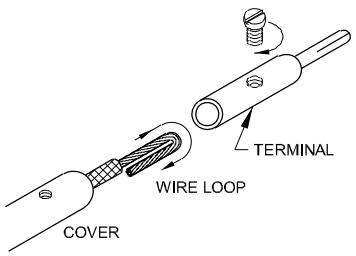


CE20N19118HE

24 Push the wire through the cover of the plug.

25 Insert the loop into the terminal (single pole plug). (Fig 15)

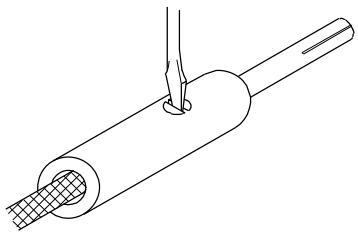
Fig 15



CE20N19118HF

26 Assemble the plug by pushing its cover over the terminal and by inserting and tightening the terminal screw with a screw driver. (Fig 16)

Fig 16



SCREWING THE TERMINAL OF THE PLUG

CE20N19118HG

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Practice on skinning, twisting and crimping

Objectives: At the end of this exercise you shall be able to
- **skin the cable insulation using the electrician's knife**
- **skin the cable insulation using manual stripper and auto-stripper**
- **practice on making a straight twist joint**
- **prepare termination of cable lugs using crimping tool.**

PROCEDURE

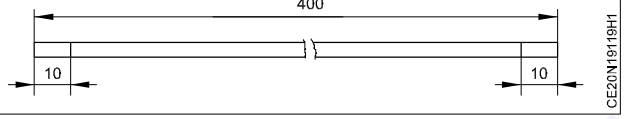
TASK 1: **Skinning cable insulation using the electrician's knife**

1 Mark the length of the 1.5 sq. mm cable at 400 mm from its end.

2 Cut the cable using combination pliers on the mark.

3 Mark the length of insulation to be skinned from either end. (Fig 1)

Fig 1



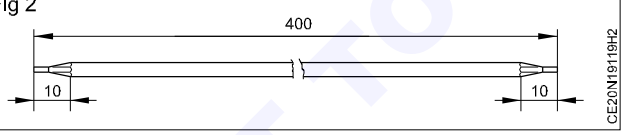
4 Check the sharpness of the knife blade and re-sharpen, if necessary.

Use an oilstone to sharpen the knife's blade.

Visible thickness at the cutting edge of the knife blade indicates a blunt edge. In the case of a sharp edge, the thickness or end will not be visible.

5 Remove the insulation of the cable for about 10 mm at the ends using a knife. (Fig 2) Keep the knife blade at an angle less than 20° to the cable.

Fig 2



6 Check for nicking over the conductor. Also check if the cable is not shaved.

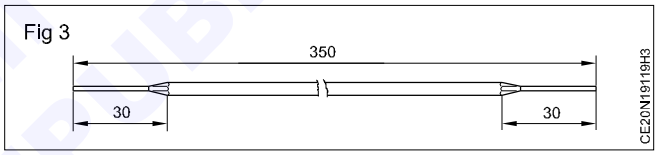
7 Clean the surface of the bare conductor and show it to the instructor.

8 Cut the cable at 12 mm from either end using a combination plier.

9 Repeat steps No.5 to No.8, until the cable is of 350 mm length

10 Mark the insulation that is to be removed as in Fig 3 and repeat steps 5 and 6.

Fig 3



11 Repeat the skinning of cable insulation of 2.5 sq. mm, 14/0.2mm, 23/0.2mm, 48/0.2mm, 80/0.2mm and 128/0.2mm flexible cables.

The length of the cable after skinning both the ends shall be suitable for termination using crimping and screw.

12 The length of the finished skinned cable should be 300, 500, 600, 800, 1000 mm.

These cable pieces are to be used for later exercises.

In the case of flexible stranded cables, ensure that the strands are not cut is essential.

— — — — — — — —

TASK 2: **Skinning cable insulation using a manual stripper**

1 Mark the length of the cable to be trimmed off.

2 Trim the cable at the mark using a combination plier diagonal cutter.

3 Straighten the ends where the insulation is to be skinned.

4 Mark the point where the insulation is to be skinned.

5 Adjust the jaws of the manual stripper and set them to suit the cable conductor.

6 Set the jaws at the mark, press the handle of the stripper and turn to cut the insulation.

Do not nick the conductor. For better practice try on a small waste piece.

7 Pull the stripper to remove the insulation.

Partially cut insulation can be removed only with more force. Excessive force, indicates improper cutting of insulation.

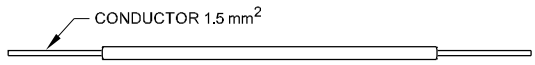
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8 Repeat the skinning of insulation for 10 mm to develop skill in the use of the wire stripper.

9 Remove insulation to the required extent at the ends as per Fig 4.

10 Be careful with flexible cables to ensure that you do not nick even a single strand.

Fig 1



TASK 3: **Skinning cable insulations using auto-stripper**

1 Mark the length of the insulation to be removed from the ends.

2 Straighten the cable ends.

3 Select a proper set of stripper.

4 Locate the jaws of the stripper exactly on the mark.

5 Press the stripper.

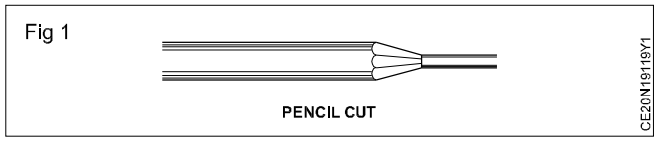
Further pressing may damage the insulation from the cable end, that is also to be removed.

6 Check that the cable conductor is not nicked.

7 Repeat steps No 1 to 7 for different sizes of cables.

TASK 4: **Pencil cut using a knife (Fig 1)**

Fig 1

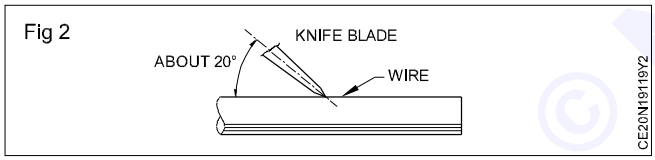


1 Set the knife to the wire

2 Hold the section to be stripped on the ball of your index finger.

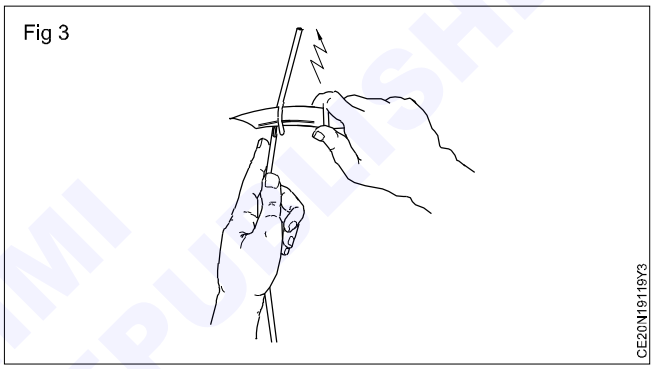
3 Hold the knife at about 20 degrees angle. (Fig 2)

Fig 2



3 Cut the insulation. (Fig 3)

Fig 3



4 Move the knife forward as you saw it back and forth.

Be sure not to damage the core.

5 Move your index finger along the direction of cutting.

TASK 5: **Twisting**

Refer - 1.9.121 TASK 1

TASK 6: **Crimping**

Refer - 1.9.123 TASK 2

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Identify various types of cables and measure conductor size using SWG and micrometer

Objectives: At the end of this exercise you shall be able to
- **identify types of wires and cables**
- **verify their specifications referring to the data book**
- **measure wire sizes using SWG**
- **measure wire size using micrometers.**

PROCEDURE

TASK 1: **Identify types of wires and cables**

The instructor will arrange and provide various types of cable and wire pieces (assorted sizes) on the table and label them with alphabets and explain them to trainees on, how to identify the types of insulation, conductors, size of wires. Demonstrate how to measure the size of wires using SWG and micrometer.

1 Take any one wire from the table, note down its alphabet in Table 1.

2 Identify the type of insulation, type of conductor material and size of wires. Note it down in Table 1.

3 Take at least five different types of wires and repeat steps 1 and 2 Note down the details in Table 1.

4 Verify the specifications of the wires by referring with the data book.

5 Take any one cable from the table, note down its alphabet.

6 Identify the type of cable (unarmoured and armoured cable) and note down in Table 1.

7 Identify the type of insulation, core and record it in Table 1.

8 Verify the specifications of the cable by referring with the data book.

9 Repeat steps 1 to 8 for various wires and note the data in Table 1.

Table 1

Sl. No.	Alphabet	Type of insulation	Type of conductor material	Type of cable		Type of core single/ 3/ 3½	Core size in mm
				Armoured	Unarmoured		
1	A						
2	B						
3	C						
4	D						
5	E						

— — — — — — — —

TASK 2: **Measuring the wire sizes by SWG in gauge number**

1 Skin the insulation of the cable.

Exercise care to prevent from nicking.

2 Clean the surface of the wire with a cotton cloth. Remove insulation particles and any adhesive coating from the surface of the conductor.

Do not use abrasives to clean the conductor. Use of abrasive material, reduces the size of the conductor.

3 Straighten the end of the conductor to be measured.

Do not straighten conductors by directly using hand tools on them.

4 Insert the conductor in the slot of the wire gauge and determine its close fit. (Fig 1)

5 Read the marking at the slot Fig 2. It gives the wire size in SWG. The other side will give you the diameter of the wire in mm.

6 Record the measured size in Table 1.

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Fig 1

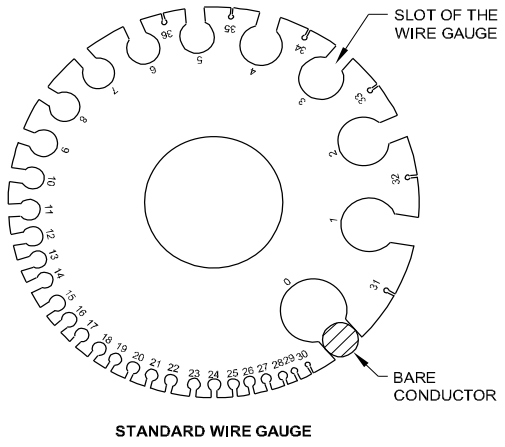
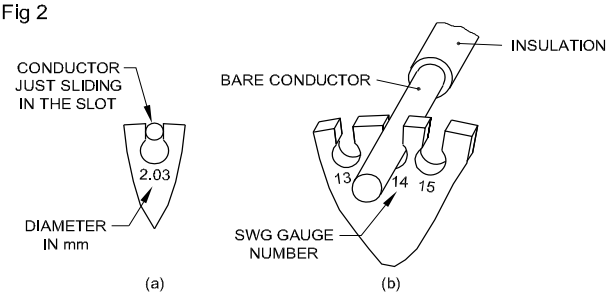


Fig 2



TASK 3: **Measuring the wire size, using micrometer**

1 Repeat steps 1-3 of TASK 2.

2 Check the micrometer for zero error by operating the spindle.

3 Record the error value with the sign- +ve or -ve.

4 Place the cleaned, straight portion of the conductor between the jaws (anvil and spindle) of the micrometer. (Fig 3)

5 Close the spindle of the micrometer by turning the thimble.

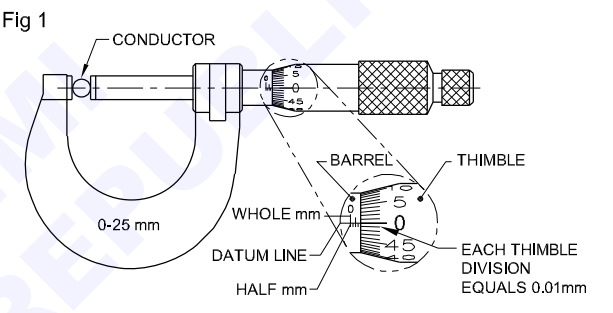
Use the ratchet drive to avoid overtightening.

6 Read and record the diameter in Table 1 after computing zero error.

7 Refer to the conversion table (Table 2) to get the size of the conductor in the standard wire gauge.

8 Repeat the steps to find the measurement for the given cables.

Fig 1



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Make simple twist, married, Tee and western union joints

Objectives: At the end of this exercise you shall be able to

- **prepare simple twist joint**
- **prepare married joint in stranded conductor**
- **prepare 'T' joint in multistranded conductor**
- **prepare western union joint in bare conductor.**

PROCEDURE

TASK 1: **Make simple (straight) twist joint as shown in (Fig 1)**

Fig 1



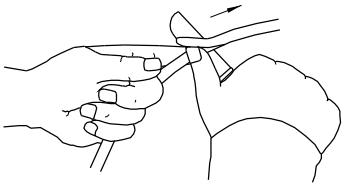
STRAIGHT TWIST JOINT

CE20N19121H1

1 Collect 2 pieces of 1/1.12 PVC copper cable of 0.5 m length and straight the cables.

2 Mark 80 mm length on one end of each piece of the cable use the knife at 20° shown in (Fig 2).

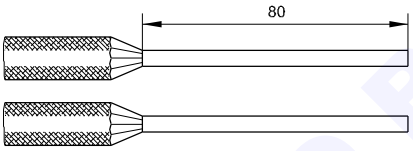
Fig 2



CE20N19121H2

3 Remove the insulation from each conductor for a length of 80 mm. (Fig 3)

Fig 3



CE20N19121H3

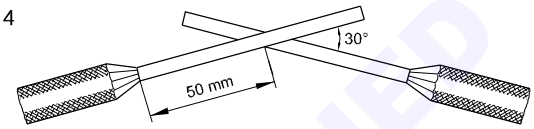
Avoid nicks in the conductor.

4 Clean the ends with the help of a cotton cloth.

Use smooth sandpaper, if necessary, to clean the conductor.

5 Place the conductors together, about 50 mm from the ends. (Fig 4)

Fig 4



CE20N19121H4

8 Twist them tightly around each other in the opposite directions. (Fig 1)

Pliers can be used to just grip the crossed conductors.

Each side should contain about 6 turns.

Each turn of the conductor should closely fit to the adjacent turn.

6 Cut the excess length of the conductor using side cutters.

7 Press the sharp edge of the conductor end and smoothen it.

Soldering the joint and insulating it with tape should be completed before putting the jointed cable in use.

8 Show the joint to your instructor.

9 Cut the joint after leaving 30 mm cable from the joint. (Fig 5)

Fig 5



STRAIGHT TWIST JOINT

CE20N19121H5

— — — — — — — —

TASK 2**: Prepare married joint in 7/0.914 stranded conductors as shown in (Fig 1)**

Fig 1



MARRIED JOINT

CE20N19121J1

1 Collect 2 pieces of PVC sheathed copper cable 7/ 0.914 0.5 metre in length.

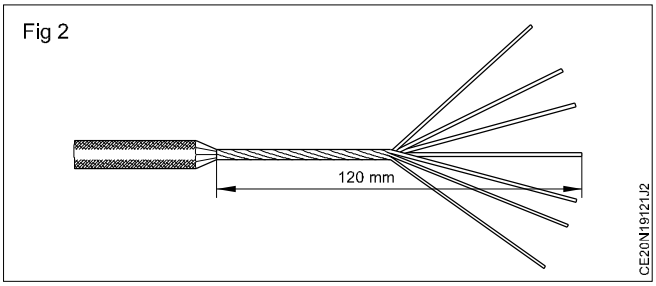
2 Mark both the cables at 120 mm from the cable ends.

3 Remove the insulation for 120 mm on both the cables.

Carefully remove the insulation. Do not nick or shave the conductor.

4 Open the strands, clean the wires, and re-twist the strands in the original direction up to 50 mm from the cable insulation. (Fig 2)

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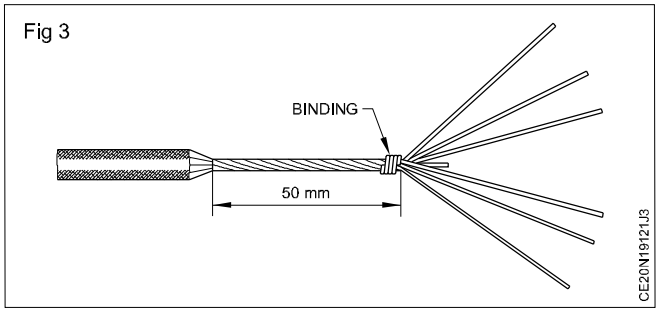
5 Cut the centre strand of both the cables close to the twist (about 70 mm from the free end).

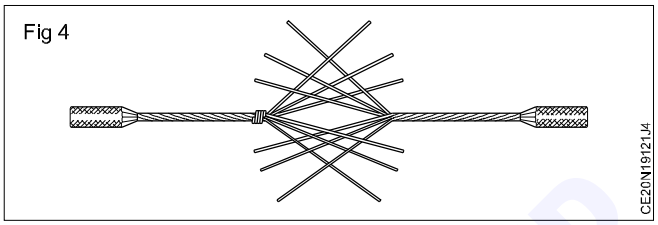
6 Bind on the twisted part of one cable end as shown in (Fig 3).

7 Interlace the strands keeping the centres butt. (Fig 4)

8 Hold the cable end (that is without the binding) in one hand and twist the strands of the other cable end over it, one by one, closely and tightly. Each strand has to be twisted half a turn at a time.

The direction of twist to form the shoulder should be the same as that of the cable twist .



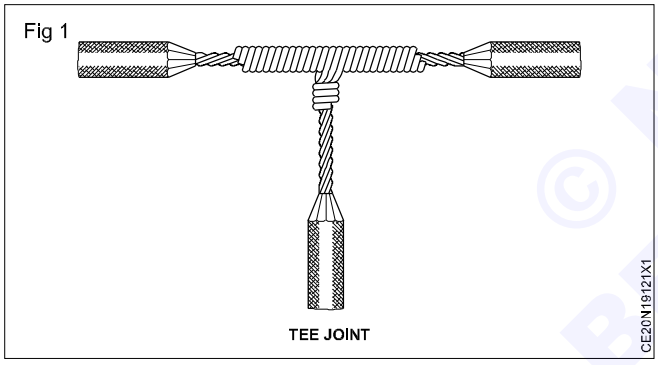


9 Remove the binding made in step 6.

10 Repeat the operation as in step 8 on the other side with the 2nd cable end.

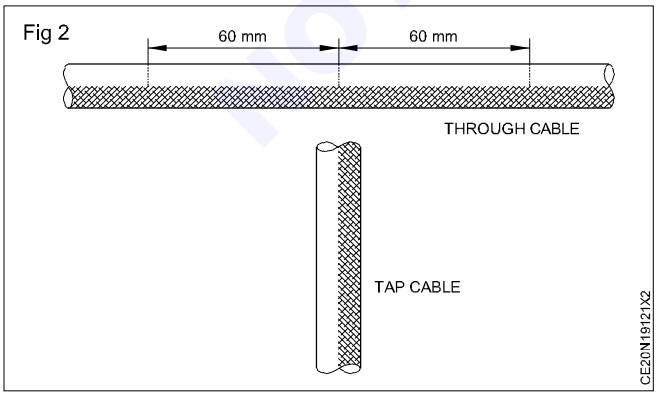
11 Complete the joint as shown in Fig 1 by rounding off the twisted strands with a mallet or pliers, and cut the excess wires.

TASK 3: **Prepare 'T' joint in multi-stranded conductor as shown in (Fig 1)**

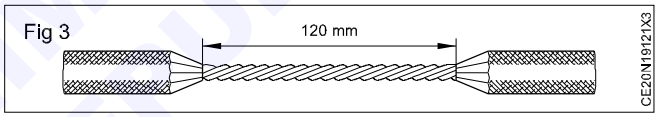


1 Collect two pieces of PVC insulated stranded copper cable 7/0.91. Indicate one piece as `through cable' and the other one as `tap cable'.

2 Mark the point of tap in the `through cable' and mark 60 mm on either side of the tap point for the insulation to be removed as shown in. (Fig 2)

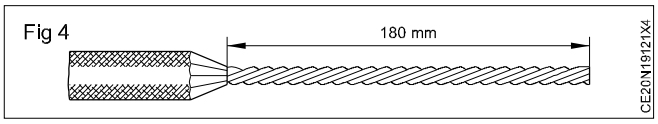


3 Remove 60 mm insulation on either side of the `through cable' from the point of tap. (Fig 3)



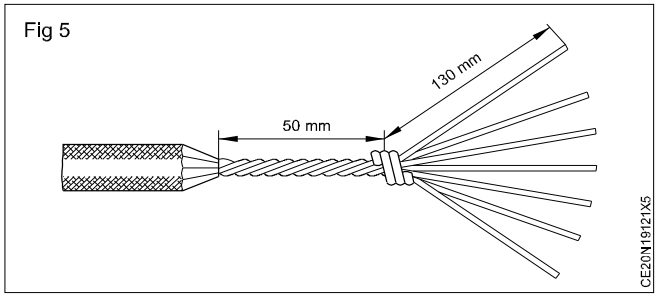
Do not nick or shave the conductor while removing insulation.

4 Remove the insulation for 180 mm at the end of the `tap cable'. (Fig 4)



5 Open the strands of the `tap cable' and clean it. Use smooth `00' sandpaper, if necessary.

6 Re-twist the strands in the original direction up to 50 mm from insulation, and make a binding on the twisted part of the `tap cable' as shown in Fig 5.

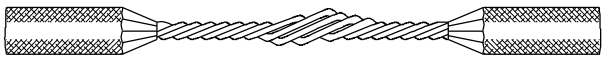


7 Untwist the `through cable' to provide opening at the point of tap. (Fig 6)

8 Insert the centre (middle) strand of the `tap cable' in the opening of the 'through cable' as shown in Fig 7.

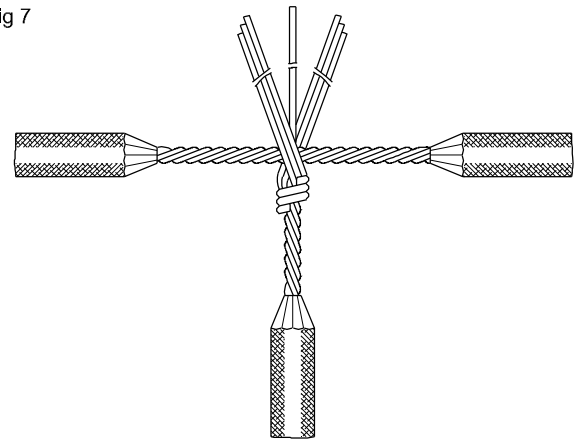
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Fig 6



CE20N19121X6

Fig 7



CE20N19121X7

9 Wrap 3 strands of the `tap cable' around the `through cable' on either side of the tap point to form shoulder on `through cable'.

10 Wrap the strands up to 50 mm to leave a 10 mm gap between insulation and shoulders (Fig 1) and trim the excess length of strands.

11 Remove the binding from the `tap cable', wrap the centre strand of the `tap cable' around the `through cable' and wrap it in the place of the binding. (Fig 1)

12 Round the ends with the combination pliers or mallet to avoid sharp edges of the strands.

13 Collect two pieces of PVC stranded aluminium cable 19/1.12, or 19/1.63, 500 mm long and repeat working steps 2 to 12.

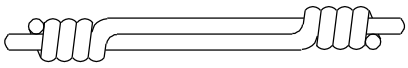
With 19/1.2, 19/1.63 mm cable, 9 strands of the `tap cable' are to be wrapped on either side of the `through cable'.

Insulation that has to be removed is 170 mm on the `through cable' and 250 mm on the `tap cable'.

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TASK 4: **Prepare western union joint in bare conductor as shown in (Fig 1)**

Fig 1



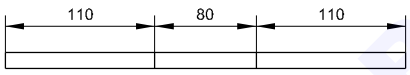
CE20N19121Y1

1 Collect two pieces of bare copper conductor of 4 mm diameter. and 30 cm long.

2 Straighten the conductor with a mallet.

3 Mark the conductor as shown in. (Fig 2)

Fig 2

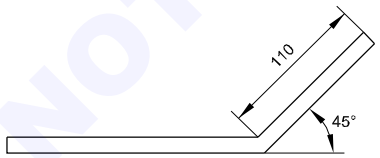


CE20N19121Y2

4 Clean both the conductors with `00' grade sandpaper to a length of 250 mm from one end.

5 Bend both the pieces of conductors at a distance of 110 mm from one end to 45° as shown in. (Fig 3)

Fig 3

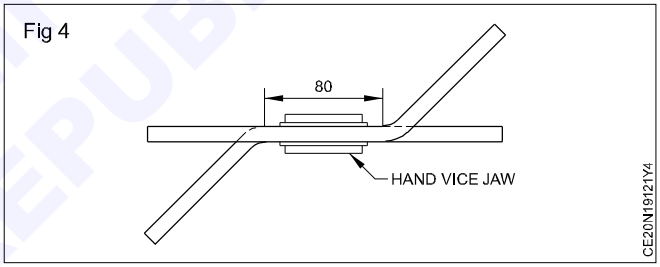


CE20N19121Y3

6 Hold the conductors in the hand vice as shown in. (Fig 4)

To avoid nicks on the conductors while gripping in a hand vice, always use soft materials like aluminium sheets between the jaws..

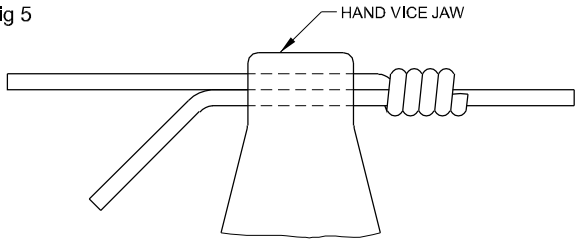
Fig 4



CE20N19121Y4

7 Wrap one conductor over the other conductor using combination pliers. Make at least 5 to 6 turns as shown in. (Fig 5)

Fig 5



CE20N19121Y5

8 Repeat the same procedure in the other end of the conductor, but wrap the conductor in the opposite direction.

9 Cut the surplus conductor ends with a diagonal cutter.

10 Use a mallet to mesh the ends with the straight conductor.

11 Smoothen the ends of the conductors with a flat file to avoid sharp edges.

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Make britannia straight, britannia 'T' (Tee) and rat tail joints

Objectives: At the end of this exercise you shall be able to
- **make britannia straight joint , 'T' (Tee) joint**
- **make rat tail joint.**

PROCEDURE

TASK 1: **Make britannia Tee joint as shown on (Fig 1)**

Fig 1



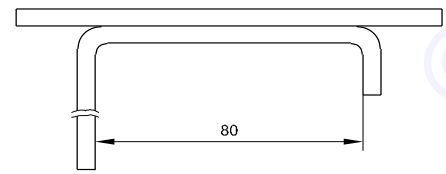
1 Collect two pieces of 4 mm diameter Hard Drawn Bare Copper (H.D.B.C) . wire, 0.2 m long.

2 Straighten the conductors using a mallet and clean it using fine sandpaper and cotton cloth.

Use the mallet to make the wires straight. The two pieces should be free from twists over the entire length of the joint.

3 Bend each piece at one end for about 20 mm length at 90° as shown in (Fig 2).

Fig 2

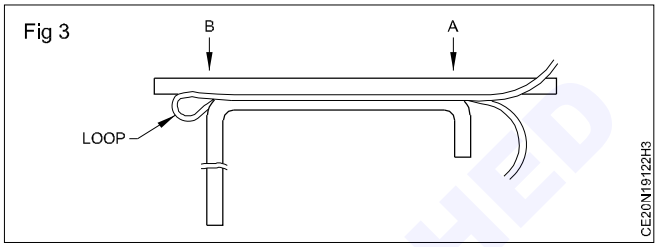


4 Collect the binding wire and straighten it without any kink.

5 Hold the two ends of the bare copper wire to be joined in the hand vice as shown in. (Fig 2)

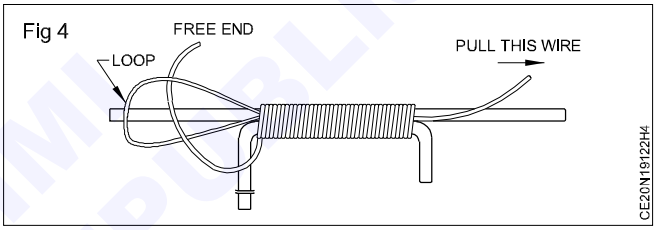
6 Form a loop of binding wire leaving one end about 250 mm at the right side of the joint. Place the binding wire in the groove formed in between the main conductors as shown in. (Fig 3)

Fig 3



7 Start binding the wire tightly over the joint from position `A' and continue till position `B'. (Fig 4)

Fig 4



8 Insert the free end of the wire inside the loop as shown in (Fig 4).

9 Grip the 250 mm loose end of the wire with a pair of pliers, and carefully pull it so that the loop and the free end of the wire go inside the joint.

10 Wrap the free end and the loose end over the conductors as shown in (Fig 1).

11 Press the ends of the binding wire to the conductors with pliers.

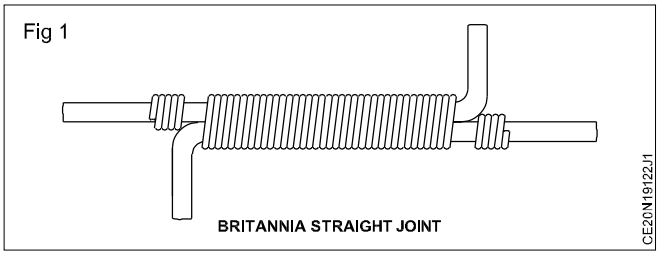
12 Smooth the sharp edges of the protruding wire ends with a flat file.

13 Repeat the above steps and make two or more joints to get more practice.

After completion of the joint, it must be soldered before putting it to use.

TASK 2: **Make britannia straight joint as shown (Fig 1)**

Fig 1

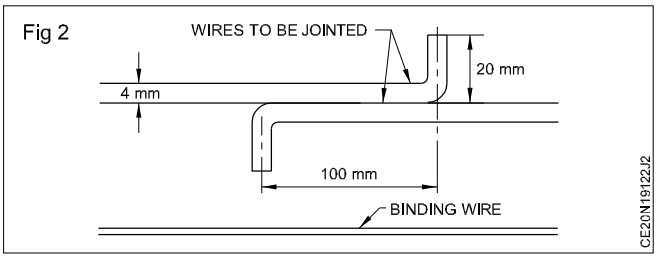


1 Collect two pieces of 4 mm diameter Hard Drawn Bare copper (H.D.B.C) 0.2 m long.

2 Straighten the conductors using a mallet and clean it with fine sandpaper and cotton cloth.

3 Bend and shape of one of the conductors according to the size shown in Fig 2, with the help of combination pliers.

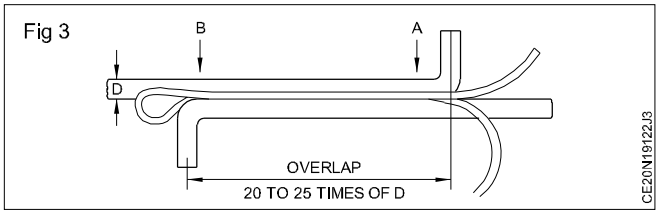
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4 Straighten the (0.914 mm diameter) binding wire.

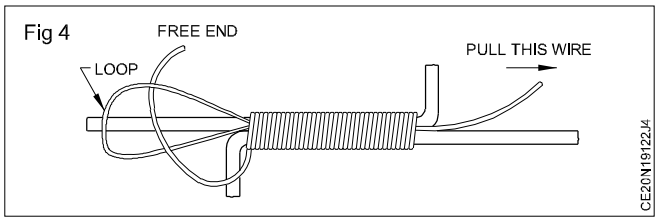
5 Hold the two copper conductors to be joined with the help of a hand vice as shown in (Fig 2).

6 Form a loop of binding wire leaving one end about 250 mm at the right side of the joint. Place the binding wire in the groove formed between the conductors as shown in (Fig 3).



7 Start binding the wire tightly over the joint from position `A' and continue till the position `B'. (Fig 3)

8 Insert the free end of the wire inside the loop as shown in (Fig 4).



9 Grip the 250 mm loose end of the wire with a plier, and carefully pull it so that the loop and the free end of the wire go inside the joint.

10 Wrap the free end and the loose end over the conductors as shown in Fig 1.

11 Press the ends of the binding wire to the conductors with plier.

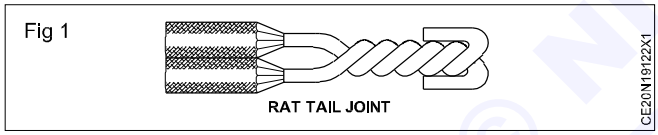
12 Smooth the sharp edges of the binding wire ends with a flat file.

13 Repeat the above procedure to make two or more joints to get more practice.

The joints need to be soldered before putting them into use.

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TASK 3: **Make rat-tail joint (Fig 1)**



1 Collect 2 pieces of 1/1.2 mm PVC copper cable of 0.5 m length.

2 Straighten the cables.

3 Skin both the cable ends for 50 mm.

4 Clean the conductor ends with the help of cotton cloth.

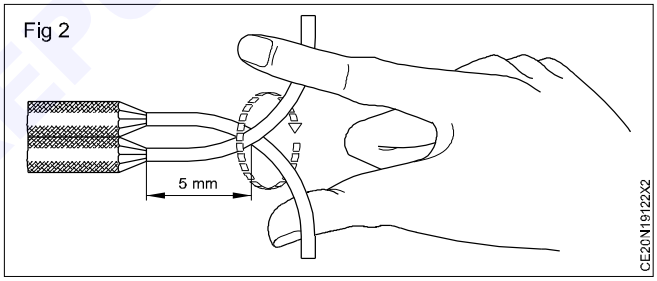
5 Cross the bare wires at of 45° and at a distance of 45 mm from the cable end.

6 Tightly twist the ends as shown in (Fig 2).

The twist on the wire should be uniform and close.

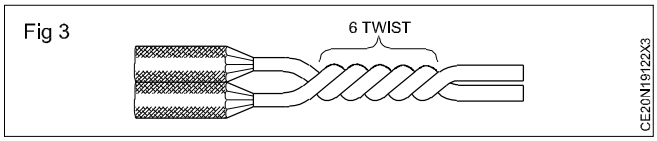
7 Make at least 6 twists. (Fig 3)

8 Fold the remaining wire back on the twists. (Fig 1)



9 Press the ends of the wire with the help of combination pliers (Fig 1) to avoid sharp ends, and cut the excess wire.

10 Repeat the steps.3 to 8 of TASK 3 for at least 4 more joints for practice, using the remaining cable.



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Practice in Soldering of joints/lugs

Objectives: At the end of this exercise you shall be able to
- **solder the copper conductor joints using a soldering iron and rosin core solder**
- **solder the lugs in copper conductor with the help of a blow lamp.**

PROCEDURE

TASK 1: **Solder the copper joints (Fig 1)**

Fig 1

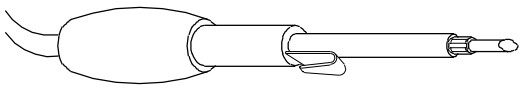


SOLDERED JOINT

CE20N19123H1

1 Select a 60W, 240V AC 50 Hz. soldering iron (Fig 2)

Fig 2



ELECTRIC SOLDERING IRON

CE20N19123H2

A soldering iron should show continuity between its terminals. Insulation resistance between the terminal and the body should not be less than 2 mega ohms. Report to your instructor in case the insulation resistance is less than 2 mega ohms. Do not use the iron unless it is cleared by your instructor.

2 Check the bit (Fig 3) to see whether the surface is smooth and clean.

Fig 3



BIT IN GOOD CONDITION WORN OUT BIT

SOLDERING BITS

CE20N19123H3

3 If found corroded, file the tip with a flat file, so that the surface is smooth and clean.

4 Connect the soldering iron to the supply and switch it `ON'.

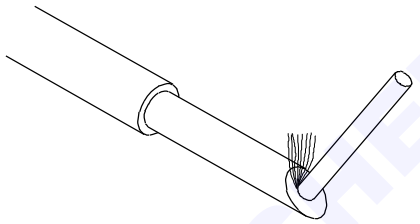
5 When the bit becomes sufficiently hot, apply a small quantity of resin-cored solder, and tin the bit. (Fig 4)

If the bit is not completely and evenly covered with solder, clean and tin it again.

Never flick excess solder off the bit. The hot solder may cause burns to someone or fall on the work and cause a short circuit.

6 Wipe the bit gently on the cleaning pad to remove excess solder.

Fig 4

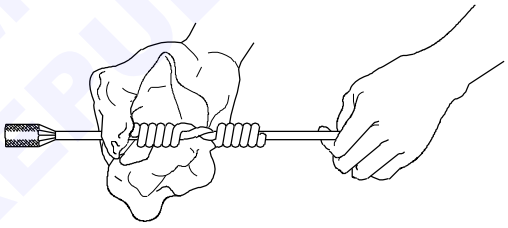


TINNING THE SOLDERING BIT

CE20N19123H4

7 Clean the joint to be soldered with the help of sandpaper `0 0', grade as shown in Fig 5, and wipe the dust with a wire brush.

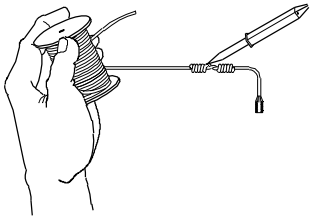
Fig 5



CE20N19123H5

8 Keep the soldering iron bit on the joint and heat it for soldering as shown in (Fig 6).

Fig 6

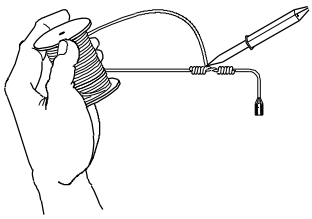


SOLDERING A SMALL SIZED JOINT

CE20N19123H6

9 Keep the resin-cored solder on the wire joint and allow it to melt as shown in (Fig 7).

Fig 7



SOLDERING A SMALL SIZED JOINT

CE20N19123H7

10 Melt the solder with the heat of the bit and make sure that the solder flows freely and evenly on the joint.

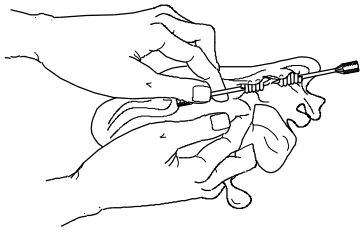
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11 Remove the soldering iron. use cotton cloth to wipe off the excess solder from the surface of the joint when it is still hot as shown in (Fig 8).

12 Allow the joint to cool naturally. Do not blow air for cooling.

A shining solder surface indicates good soldering. Do not move the joint until the solder solidifies.

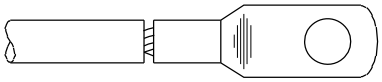
Fig 8



CE20N19123H8

TASK 2: **Solder lug to a copper conductor (Fig 1)**

Fig 1



SOLDERED LUG

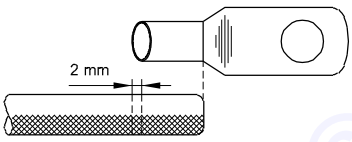
CE20N19123J1

1 Collect a 30 amps cable lug, copper cable 7/1.06 or 7/ 0.914(6 sq.mm) of 250 mm length, blowlamp, matchbox, cotton cloth, solder stick, tray and flux.

2 Clean the inner and outer surfaces of the 30 amps cable lug using `00' grade sandpaper.

3 Put the cable lug to one end of the cable and mark the cable according to the depth of the cable lug, as shown in (Fig 2).

Fig 2

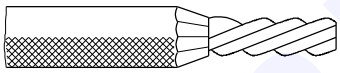


MEASURING CABLE FOR FIXING LUG

CE20N19123J2

4 Add about 2 mm to the marking, remove the insulation from the cable (Fig 3) and clean the strands.

Fig 3



CABLE WITH REMOVED INSULATION

CE20N19123J3

5 Wrap a cloth/cotton tape on the insulation of the cable to a length of 30 mm and wet it with water.

Use minimum water to wet the cloth/tape. Do not allow water to drip.

6 Light the blowlamp and let it emit a blue flame.

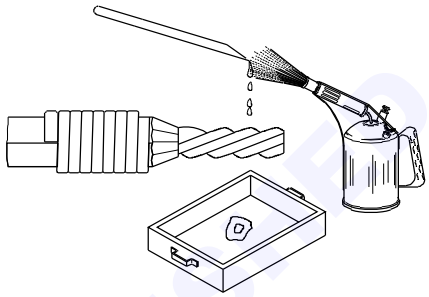
7 Apply a thin coat of flux to the cable end.

8 Tin the cable end by monitoring the blowlamp on the solder stick and allowing the molten solder to fall on the bare stranded cable end as shown in (Fig 4).

9 Apply a small quantity of flux inside the lug socket. Tin the lug by melting the solder stick to fill the socket and pour the molten solder in the tray.

Pouring out the molten solder from the lug socket a couple of times will make the tinning perfect.

Fig 4



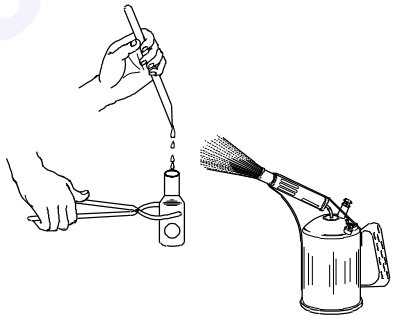
TINNING CABLE END

CE20N19123J4

10 Apply some flux to the cable end and the interior of the socket.

11 Fill the socket of the lug with molten solder. (Fig 5)

Fig 5



CE20N19123J5

12 Monitor the blowlamp flame on the socket, insert the cable in the socket and hold the cable vertically.

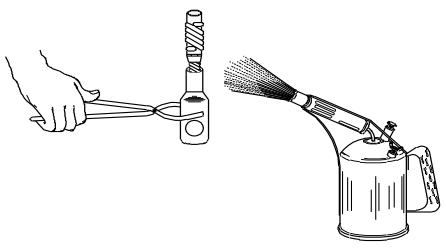
13 Remove the blowlamp and firmly hold the cable and socket without shaking.

14 Remove the extra solder from the lug and cable by wiping it with a piece of cotton cloth while the solder is still hot.

15 Keep on holding the cable and lug as in Fig 6 and allow the solder to solidify.

Do not use water to cool the lug. This will crystallize the solder and make it weak.

Fig 6



CE20N19123J6

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Demonstrate different electrical wiring system with different accessories

Objectives: At the end of this exercise you shall be able to
- **Demonstrate the different electrical wiring system and different accessories.**

PROCEDURE

Instructor shall display and demonstrate to the students regarding the different electrical wiring system and different accessories in the section and brief the names and applications.

TASK 1: **Demonstrate the circuit diagram of service panel and control switch board wiring (Fig 1 & 2)**

Fig 1

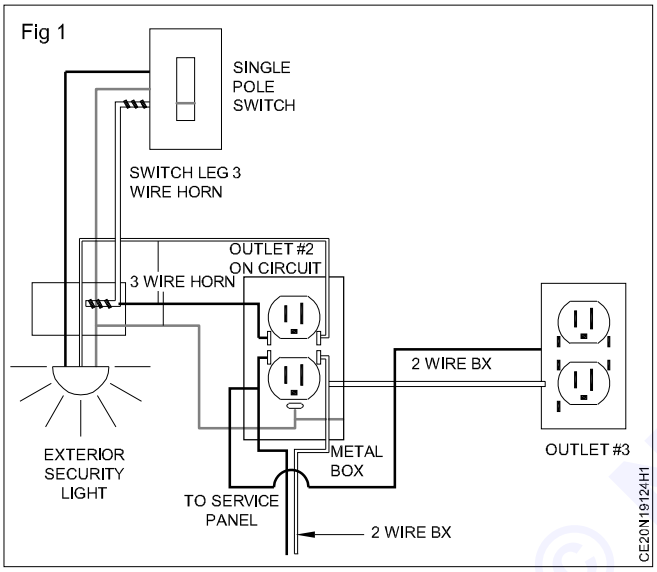
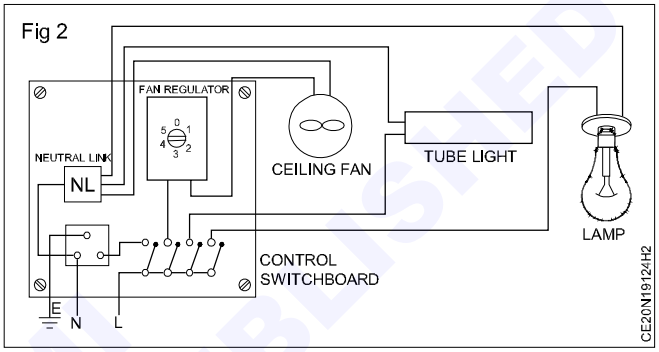


Fig 2



TASK 2: **Demonstrate the given circuit diagram with fuse and three pin socket (Fig 1) and electrical wiring diagram of load with voltmeter and ampere meter (Fig 2)**

Fig 1

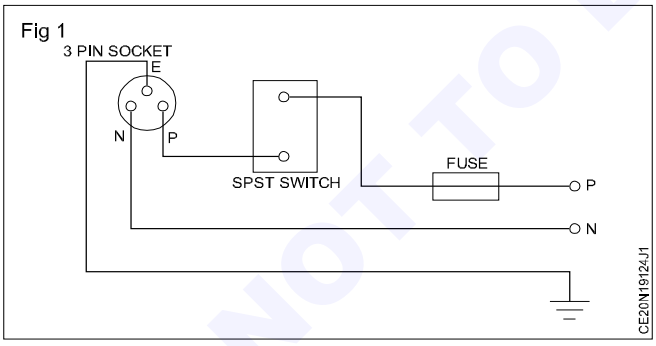
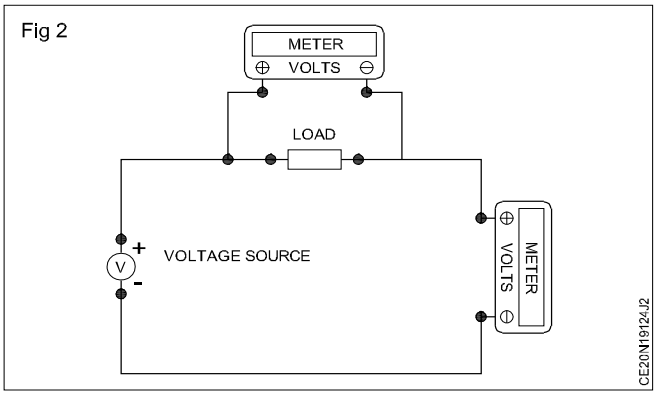


Fig 2



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TASK 3: **Demonstrate the circuit diagram with load and multimeter of DC source supply (Fig 1) and wire connection of three wire connection diagram (Fig 2)**

Fig 1

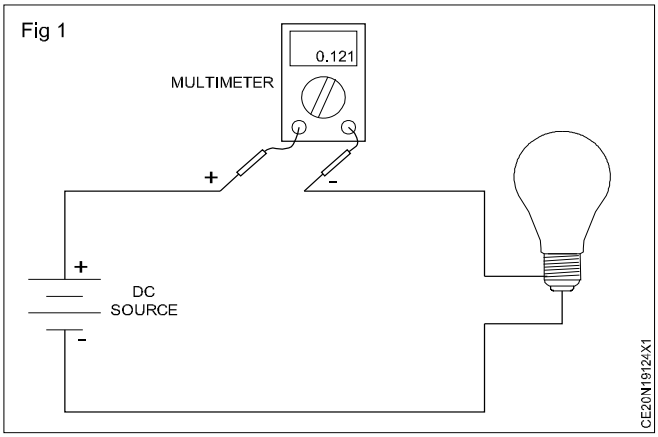
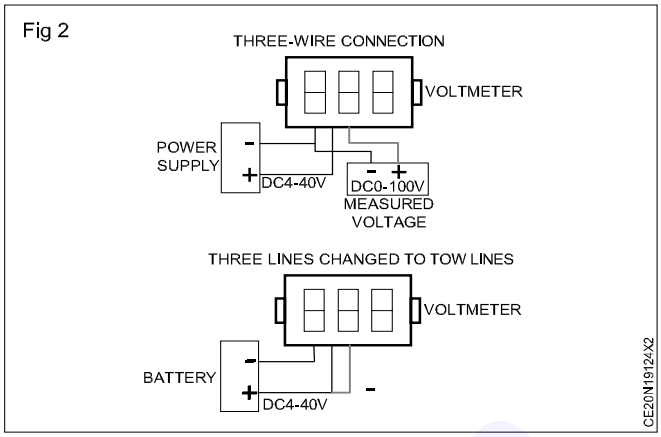


Fig 2



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Make electrical fuse joints, fixing MCB

Objectives: At the end of this exercise you shall be able to
- **make the circuit diagram with fuse joint and fixing of MCB**
- **make the wiring diagram with MCB and house wiring diagram.**

PROCEDURE

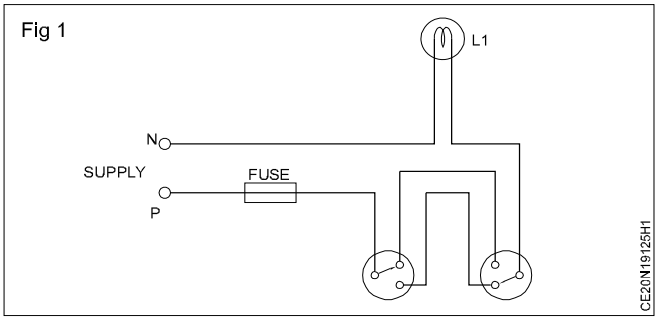
TASK 1: **Make the circuit diagram with fuse joint and MCB**

1 Set the materials as per circuit diagram with specification.

2 Make connection phase wire with fuse.

3 Fuse and switch are made in series connection as shown in (Fig 1).

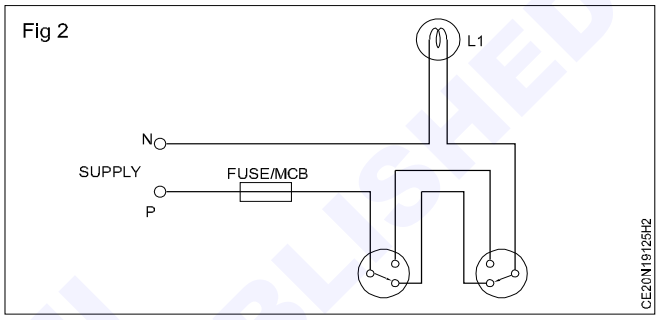
Fig 1



4 Connect the neutral wire directly to the load terminal.

5 Another terminal is connected with switch terminal as shown in (Fig 2).

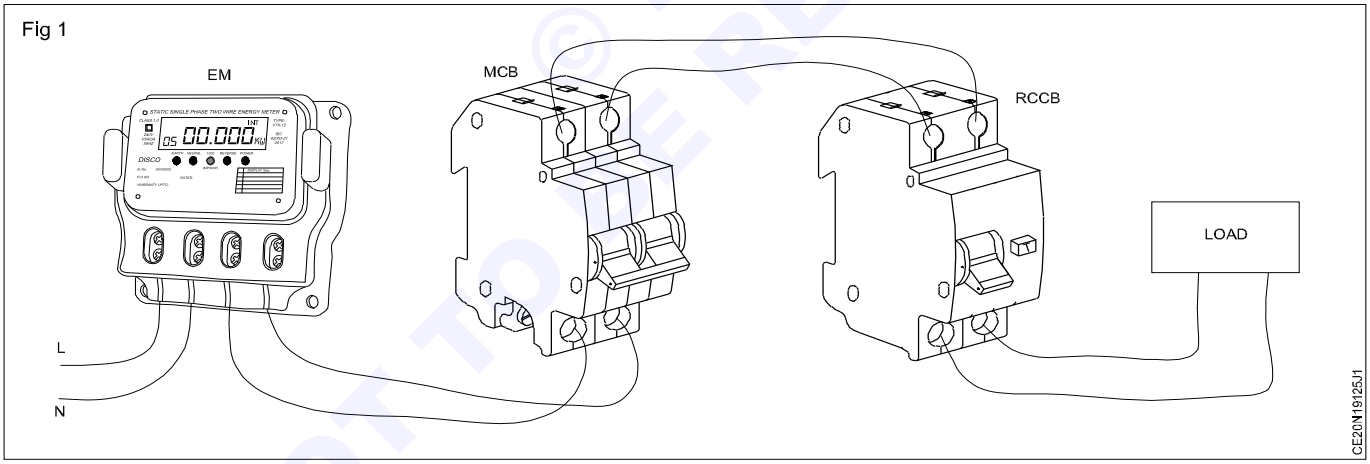
Fig 2



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TASK 2: **Make the MCB wiring diagram and house wiring diagram (Fig 1)**

Fig 1



Note: Instructor should explain the following diagrams and the trainee should study the futures of the diagram.

1 Get the material as per circuit with specification.

2 Connect the supply (phase - neutral) to energy meter (parallel connection)

3 Then make connection from energy meter to MCB (parallel connection)

4 Take connection from MCB output to RCCB input (parallel connection)

5 RCC output is connected to load.

6 Make connection of phase and neutral wise same sequence from MCB, RCCB and load

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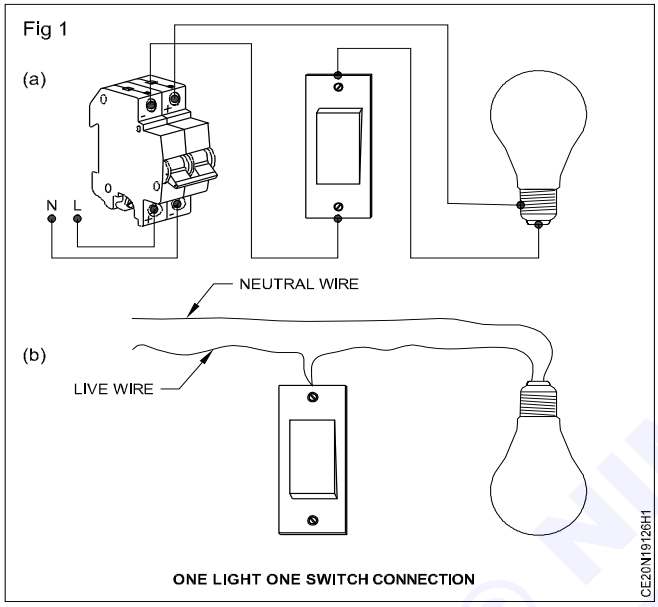
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Connect lamps with switches

Objectives: At the end of this exercise you shall be able to
- **make the circuit diagram of one light one switch diagram of lights in parallel**
- **make the connection of the given switches.**

PROCEDURE

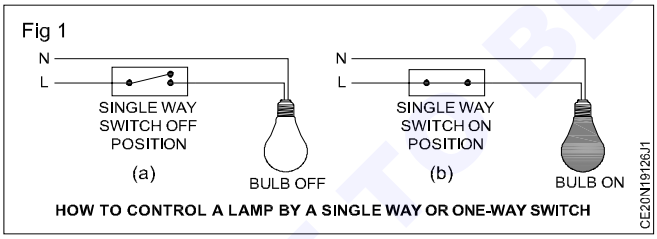
TASK 1: **Make the circuit diagram of one light one switch connection and connect lamps with switches, incandescent lamp - 100 and two pole isolator 15 a, one way switch sa - 230v wire (Fig 1a & b)**



- Collect the necessary things for this to use.
- Connect the accessories as shown in (Fig 1).
- Connect the phase wire through switch to load.
- Natural wire connect directly to load.
- Give supply and test the circuit.

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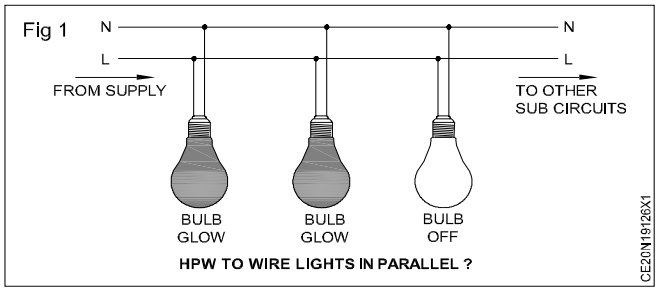
TASK 2: **Make the circuit diagram of single way switch off position and on position and connect lamps with switches (Fig 1a & b)**



- Collect two way switch 6 A ,230 V, mm PVC multistrand copper wire and incandescent lamp - P - 100W
- Collect the accessories for this task.
- Connect the accessories for this task as shown in (Fig 1).
- Connect the phase wire to switch then lamp in series connection.
- Neutral directly given to lamp.
- Give supply and test the circuit.

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TASK 3: **Draw the diagram showing the lights in parallel and connect lamps with switches (Fig 1)**



- Collect two way switch 6 A ,230 V, mm PVC multi strand copper wire and incandescent lamp - P - 100W
- Connect the accessories this task.
- Give supply and test the circuit.
- Observe the light of lowing when switch is ON.

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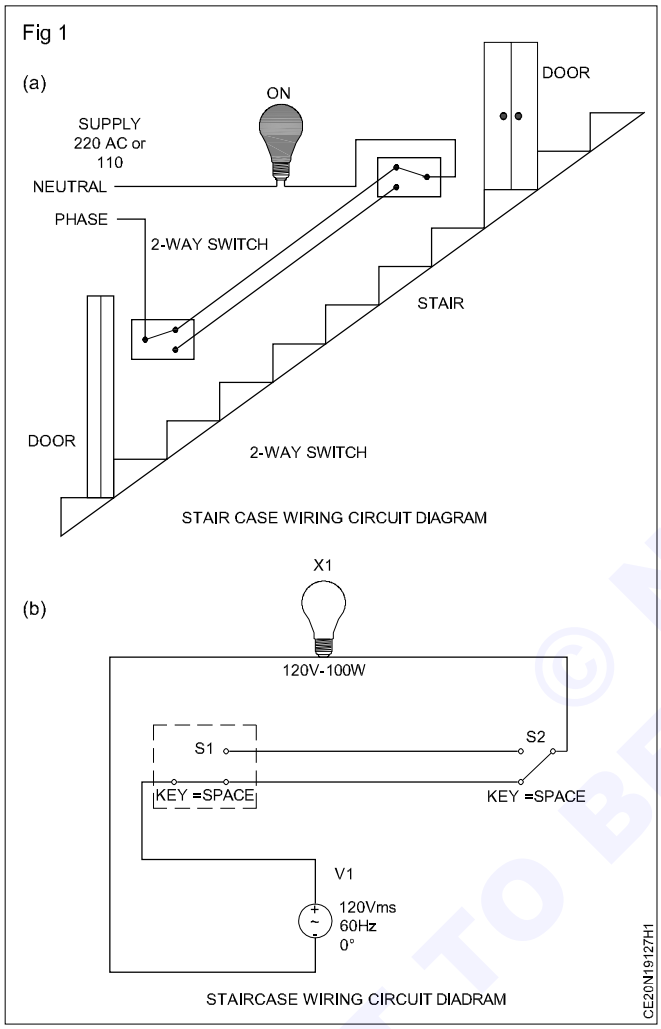
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Staircase circuit wiring and godown wiring

Objectives: At the end of this exercise you shall be able to
- **make the staircase circuit wiring and connect lamps with switches**
- **make the godown wiring and connect lamps with switches.**

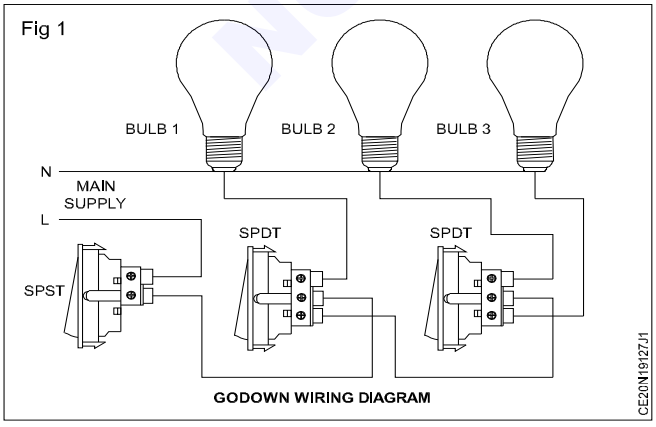
PROCEDURE

TASK 1: **Make the given staircase wiring circuit diagram (Fig 1a & b)**



- Collect the accessories for two way switches 6 A - 230 V, 1 mm copper multi strand PVC wire and incandescent lamp 100w for this task.
- Connect the accessories as shown in (Fig 1).
- Give supply and test the circuit.
- Check the status of switches of S1, S2.
- Change both S1, S2 switches position and observe the status of lamp.

TASK 2: **Make the godown diagram as per the given drawing (Fig 1)**



- Collect the accessories for two way switches 6 A - 230 V, 1 mm copper multi strand PVC wire and incandescent lamp 100 w for this task.
- Connect the accessories as shown in (Fig 1).
- Give supply and test the circuit.
- Switch ON all switches S1, S2 and S3.
- Observe the lamp glowing.

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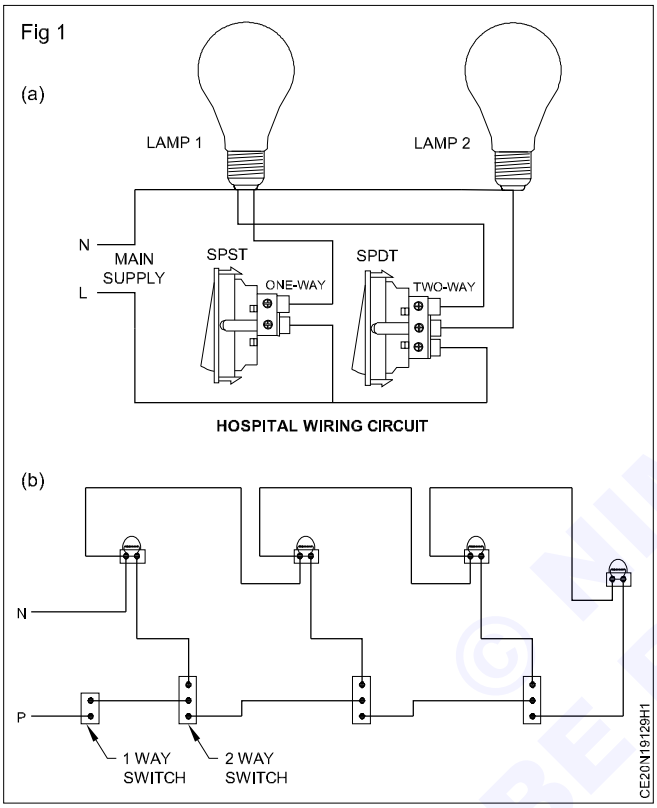
Hospital wiring

Objectives: At the end of this exercise you shall be able to
- **make the hospital wiring diagram.**

PROCEDURE

TASK 1: **Make the hospital diagram circuits and demonstrate for circuits and fixing of different accessories for one-way switch 6A, 230V, two-way switch 6A, 230 V, stand PVC copper wire. (Fig 1a, b &c)**

Fig 1



- Get the accessories as per circuit diagram
- Connect the lamp, switches as shown in Fig 1
- Switch On the master S_1 switch and check the lamp glowing
- Check all other switch ON and observe the lamp glowing.

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Install earthing in different position

Objectives: At the end of this exercise you shall be able to
- **prepare the pipe earthing and plate earthing**
- **install the pipe earth and plate earth.**

PROCEDURE

TASK 1: **Install the pipe earthing**

1 Collect G.I.pipes and the accessories.

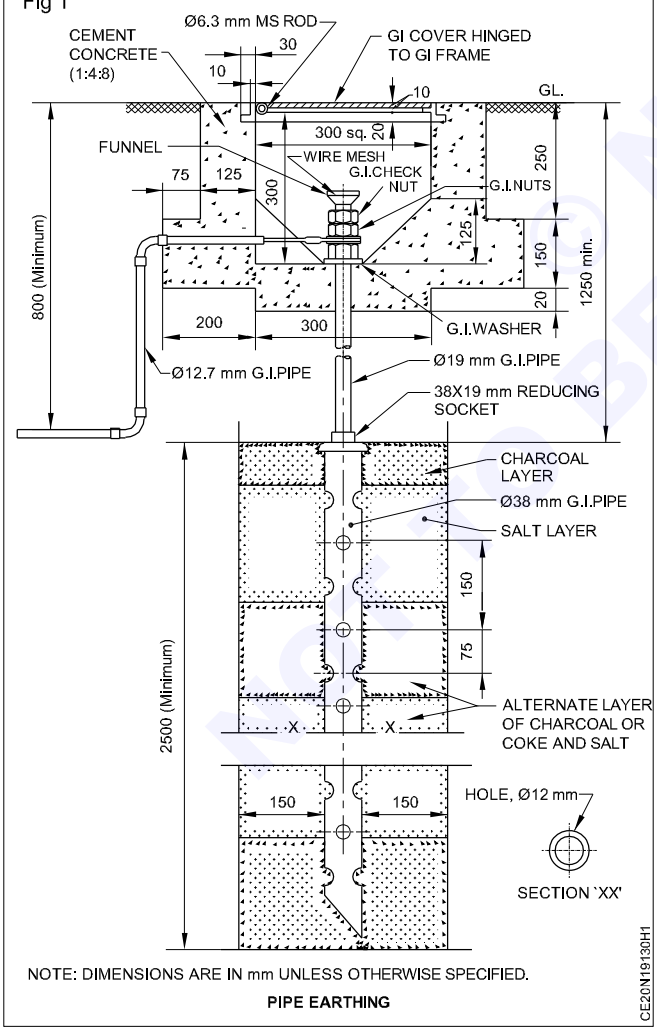
2 Make a slant cut of 30° in the 38mm dia. of G.I.pipe to have sharp edge as shown in Fig 1.

3 Make threads on the other end of 38mm dia. G.I.pipe to a length of 25mm.

4 Make threads in both ends of 19mm dia. G.I.pipe to a length of 25mm on one side and 75mm on the other side.

5 Fabricate the 38mm and 19mm dia. G.I. pipes as shown in Fig 1.

Fig 1



6 Select an earth pit site atleast 1.5 metres away from the building foundation.

An earth electrode should not be installed in proximity to a metal fence to avoid the possibility of the fence becoming live. If the metal fence is unavoidable, it should be earthed.

7 Dig an earth pit of dimensions 1 m width x 1 m breadth x 3.75 m depth.

The depth given here is the minimum recommended. However, the depth may be increased till moist soil is reached.

8 Place the fabricated pipe in an upright position as shown in Fig 1 and position the pipe with the help of bamboo sticks.

9 Place the wooden box around the pipe and fill it to a height of about 15cm with charcoal, and fill the surrounding outer space of the box with soil.

It is difficult to dig a pit 150mm square. A pit of dimension 1 metre square is therefore suggested to be dug. The area sufficient to be filled with salt and charcoal is about 150mm square. Hence fill the surrounding extra area with the soil which was taken out earlier.

10 Lift and place the wooden box above the coke layer. Fill up with salt to a height of about 15cm and to an area of 150 x 150mm area around the pipe.

Fill up the surrounding area with soil.

11 Repeat the above steps 9 and 10 up to 2.5 metres as shown in Fig 1.

12 Place the G.I.pipe 12.7 mm dia. meter with G.I. bends in proper position for E.C.C. connection.

13 Prepare the concrete mixture and build the structure as shown in Fig 1.

14 Fix the G.I. cover also.

Atleast allow one day for curing the concrete structure. Pour water every 2 hours. (A wetted gunny sack will hold the moisture for several hours.)

15 Insert the G.I.wire No.8 SWG through the 12.7mm dia. G.I.pipe.

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The size of the earth wire depends upon the incoming supply cable size.

16 Use the ladle and the blowlamp and melt the solder.

17 Solder the lug in the G.I. wire.

18 Insert the lug in the 19mm dia. G.I.pipe and tighten it with the G.I.nut and check-nut.

19 Pour three or four buckets of water through the funnel.

Allow an hour for the water to be absorbed in the earth.

20 Test the earth electrode resistance with an earth Megger.

TASK 2: **Prepare the plate for earthing according to ISI standard**

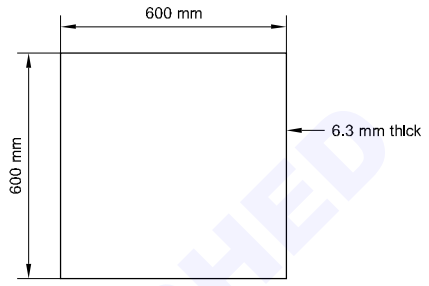
1 Collect G.I plate and accessories for earthing

2 Mark thread on one side of 19mm dia GI pipes to a length of 25mm

3 Fabricate GI plate as shown in Fig 1 600mmx600mm square plate with a thickness of 63mm

4 Fabricate 19mm dia G.I pipe as shown in Fig 1.

Fig 1



TASK 3 : **Prepare the earthing pit in ground as per standard**

1 Select an earth pit site atleast 1.5meters away from the building foundation

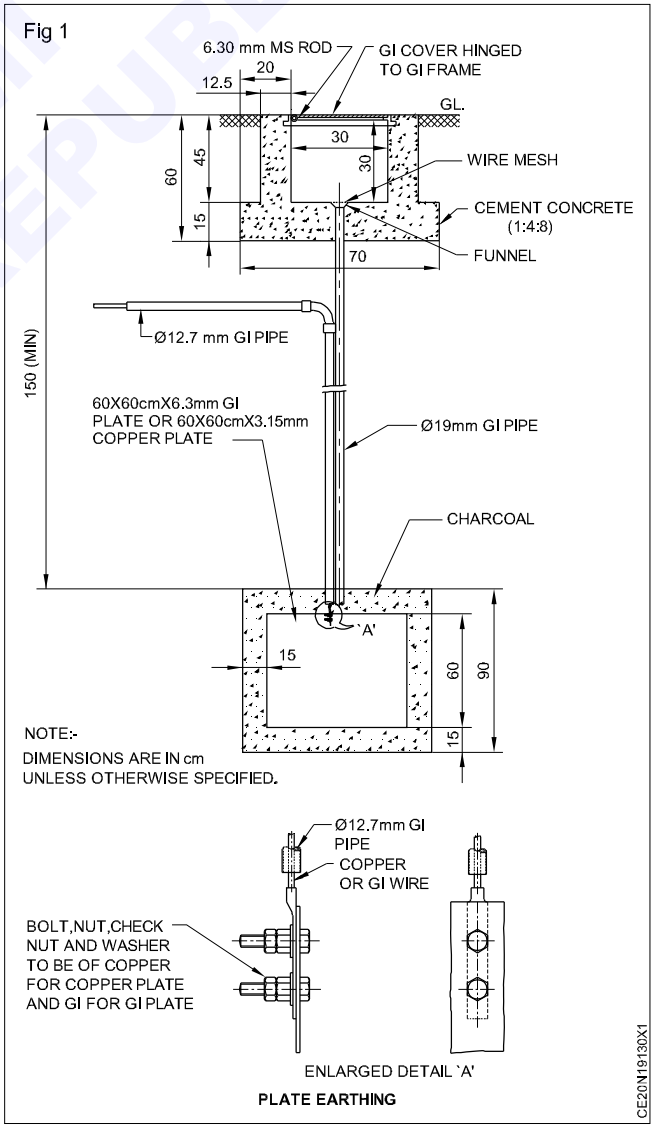
An earth electrode should not be installed in proximity to a metal fence to avoid the possibility of the fence becoming live. If the metal fence is unavoidable it should be earthed

2 Dig an earth pit of dimensions 1m width x 1m breadth x2.5m depth

The depth given here is the minimum recommended. However, the depth may be increased till moist soil is reached

3 Fabricate G.I pipe 12.7mm diameter with GI bonds in proper position and insert the G.I wire through GI pipe by soldering lug at external and fix GI plate with bolt and nut as shown in (Fig 1)

Fig 1



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Install and connect electrical appliances and take reading with voltmeter

Objectives: At the end of this exercise you shall be able to
- **connect the AC digital voltmeter and measure the AC voltage**
- **connect the AC digital voltmeter measure the voltage drawn by a circuit.**

PROCEDURE

TASK 1: **Measurement of AC voltage**

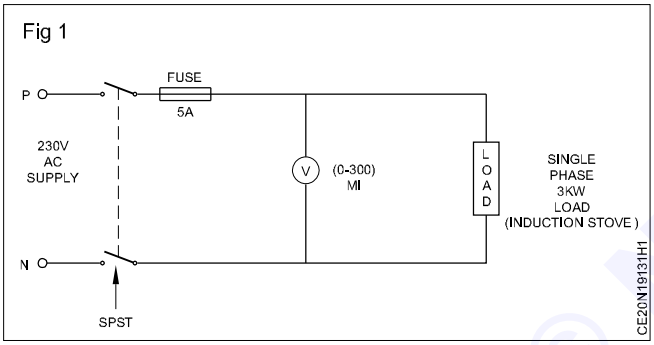
1 Observe the terminals of the digital voltmeter.

2 Identify the auxiliary supply terminals of the digital voltmeter which are marked as 240V AC - Aux.

3 Identify the voltage measurement terminals which are marked as V_1 V_2.

4 Connect the 240V AC supply across the auxiliary supply terminals of the voltmeter as shown in Fig 1

Fig 1



Always connect the terminals V_1 V_2 across the voltage that is to be measured.

TABLE 1

Sl. No.	Measured voltage
1	
2	
3	
4	

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Prepare a materials list and costing of wiring

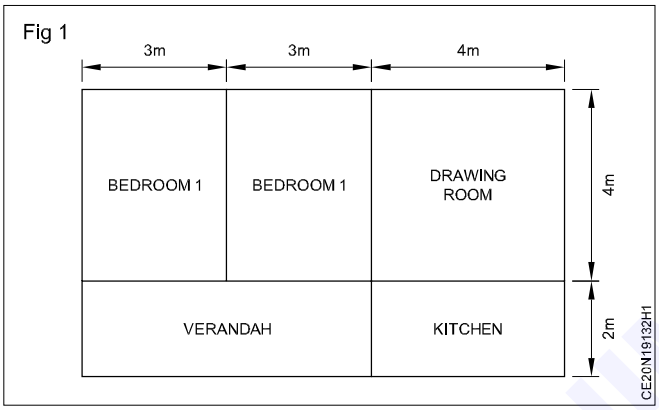
Objectives: At the end of this exercise you shall be able to
- **calculate the total load in sub-circuit**
- **select the size of cable in the sub circuits**
- **estimate the quantity of materials**
- **estimate the cost of wiring.**

PROCEDURE

TASK 1: **Estimate the cost/bill of material for wiring of hostel / residential building**

1 Obtain the building plan as shown in Fig.1

Fig 1



2 Collect the requirements of lights, fans, lighting and power sockets etc.

3 Mark the location of switch board, Power loads and DB in the plan.

The type and quantity of loads depend upon the customer's requirement. Hence, complete data are to be collected before starting estimation. A sample requirements is given for the trainee's reference.

The wall thickness	- 40 cm
The height of roof from ground	- 3.5 m
Height of conduit run	- 3 m
Height of main board	- 2.5 m
Height of switch	- 1.5 m
Height of light brackets	- 3 m
Height of main board	- 3 m

The details of standard requirement of Power loads are given in Table - 1

Table -1

Location	Light (60 W)	Fan (80 W)	6A Plug Point (80 W)	16A Power Plug (1000 W)
Verandah	1	1	1	1
Kitchen	1	1	Nil	1
Bedroom	2 +2	1 + 1	1 + 1	Nil
Drawing Room	2	1	1	Nil

4 Calculate the number of sub circuits required for the above load as per IE rules.

Indian electricity rule states that there should be separate sub circuits for light/fan loads and power loads. Therefore 6A plug points (Sockets) are considered as light / fan load points as they are meant for connecting table fan /table lamp etc. 16A power plug are considered as power points as they are used for connecting heavy loads like heaters, kettles etc.

Total wattage of light points = 8 x 60 = 480 W

Total wattage of fan points = 5 x 80 = 400 W

Total wattage of (6A) sockets = 4 x 80 = 320 W

Total 17 Nos = 1200 W

As there are 17 points, we need two sub - circuits. The division of outlets on each sub circuit is made more or less uniform, ie., 8 & 9. Refer Fig 2

5 Draw the layout of conduit, switch board, loads and DB as shown in Fig 3.

6 Calculate the size of each cable as shown below.

i current through subcircuit-1

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$$= \frac{(5 \times 60) + (2 \times 80) + (2 \times 80)}{230} = 2.696 \text{ A}$$

ii Current through sub circuit -2

$$= \frac{(3 \times 60) + (3 \times 80) + (2 \times 80)}{230} = 2.522 \text{ A}$$

iii Current through sub circuit 3 $= \frac{2000}{230} = 8.696 \text{A}$

Fig 2

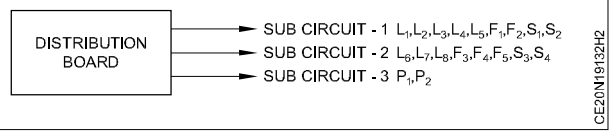
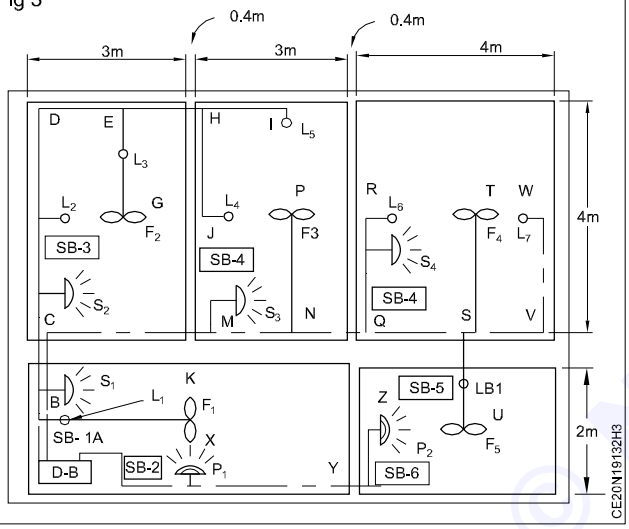


Fig 3



Total current = 2.696+2.522+8.696 = 13.9 A

16A, 250V flush type DP main switch is sufficient

7 Calculate the length of PVC conduit and cable as shown below.

19mm conduit can be used up to ABC length and for remaining length, 12mm conduit is sufficient.

Horizontal runs

19mm conduit for length ABC	= 2.4 m
19mm conduit for length at C (wall thickness)	= 0.4 m
Total	**= 2.8 m**

12 mm Conduit

Length CDEHI (4 + 3 + 1.5)	= 8.5 m
Length EG	= 2.0 m
Length HJ	= 2.0 m
Length CMNQSVW (3+3+4+2)	= 12.0 m
Length MS3	= 1.5 m
Length NP	= 2.0 m
Length QR	= 2.0 m
Length ST	= 2.0 m
Length SV	= 1.0m
Length BK	= 3.0 m
Length AXYZ (6+1)	= 7.0 m
Length (wall thickness) at C, H, M, Q, S & Y (6x0.4)	= 2.4 m
Total	**= 45.4 m**

Vertical down drops (horizontal run to SB's) :

19 mm conduit

Length B to roof	= 0.5 m
Length E to roof	= 0.5 m
Length N to roof	= 0.5 m
Length S to roof	= 0.5 m
Total	**= 2.0 M**

Total 19 mm conduit required = 2.8+1.5+0.5 = 4.8 m

Wastage 10%	= 0.48 m
Total	= 5.28 m (Take 6m)

Total 12mm conduit required 45.4+10.50= 55.9 M

Wastage 10%	= 5.59 m
Total	= 61.49 m (Take 62m)

Cable for (power) sub circuit -3 (1/1.8m AI)

= 3 x (6+1+1.5+1.5) = 30 m

Cable for sub circuit 1 & 2 (1.0 mm^2 copper)

= 3 x (6+62-10) = 174 m

Trainees shall select the cable size by referring the table given in related theory

8 Calculate the labour cost.

Meter board	= 2 Points
Distribution board	= 2 Points
Light / fan	= 17 Points
Power	= 2 Points
Total points	**= 23 Points**

Labour cost / point should be taken by referring the local rate list.

For example, take the labour cost is Rs.100/point

Then, total labour cost is 23 x 100 = Rs.2300/-

9 Prepare a list of "material of schedule and cost" as shown in Table-2.

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Table 2

Material of schedule and cost

Sl.No.	Material Specification	Rate Cost				
		Qty.	Rs. Ps.	Per	Rs. Ps.	Remarks
1	D.P Main switch 10A, 240V flush type	1 No	.....	each	.....	For M.B For power load
2	I.C cut out 16A, 240V	1 No	.....	each	.....	
3	Flush type fuse unit 16A	1 No	.....	each	.....	
4	Flush type fuse unit 6A	2 Nos	.....	each	.....	
5	PVC conduit 19 mm (heavy gauge)	6 m	.....	length	.....	1 length = 3 m
6	PVC conduit 12 mm (heavy gauge)	62 m	.....	length	.....	1 length = 3 m
7	1.0mm^2 multistrand copper, VIR cable	174 m	.....	100m	.....	
8	1/1.8 mm aluminium VIR cable	30 m	.....	100m	.....	
9	1/1.8m copper VIR cable	2 m	.....	100 m	.....	From M.B to D.B
10	Switches 6A, 240V one way flush type	17 Nos	.....	each	.....	
11	2-pin sockets 6A, 240V	4 Nos	.....	each	.....	
12	3 -pin sockets 16A, 240V with switch and neon	2 Nos	.....	each	.....	
13	Ceiling rose 2 - plate 6A 240V	5 Nos	.....	each	.....	
14	Lamp holders brass batten type	8 Nos	.....	each	.....	
15	PVC junction boxes 25 mm 4 - way	1 No	.....	each	.....	
	12 mm 3-way	7 Nos	.....	each	.....	
	12 mm 2-way	5 Nos	.....	each	.....	
16	PVC bends 12 mm	4 Nos	.....	each	.....	
17	PVC reducers (25 mm to 12 mm	1 No	.....	each	.....	
18	Saddles 25 mm	24Nos		Doz	.....	
	12 mm	144No		144 Nos	.....	
19	Wooden boards (a) 30 x 30 Cm	2 Nos	.....	each	.....	For M.B & D.B For S.D's
	(b) 18x10 Cm	7 Nos	.....	each	.....	
20	Round blocks	5 Nos	.....	each	.....	
21	Wooden gutties/plugs 9cm2 x 4 cm^2 x50 mm	3 doz		doz	.....	For boards
22	Nails 25 mm	1 kg		kg		Per conduit
23	Wooden screw 60 mm	25 Nos		100		For boards
	Wooden screw 12 mm	25 Nos		100	....	For holders
24	Copper wire (16SWG) for earth	1 Kg		kg	.....	
	(GI WIRE 14 SWG)	1 Kg		kg		
25	Earth set (Pipe, salt, coal)	1 set		...	.....	
26	Cement	2 kg		kg		
27	Labour cost	2 kg			.....	For 4 gutties
	Total				.....	
	Contingency 10%				.....	
	Grand Total					

The rate of each material shall obtained from the price list of the branded items

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Identify transformer, test and use

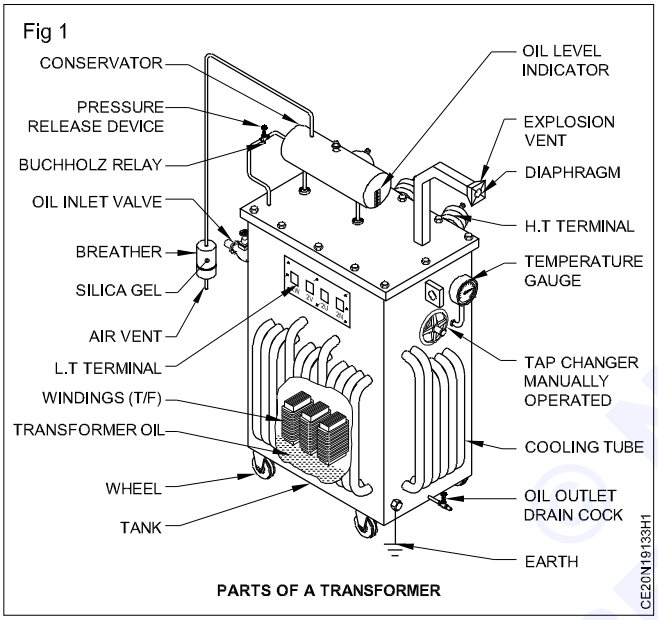
Objectives: At the end of this exercise you shall be able to
- **make and identify the parts, and uses**
- **conduct open circuit test to determine iron or core loss**
- **conduct shot circuit test to determine full load copper loss of a transformer.**

PROCEDURE

Instructor shall display and demonstrate to the students regarding the transformer in the section and brief its parts name, test and use.

TASK 1: **Draw and identify the transformers shown in figure and name its parts (Fig 1)**

Fig 1



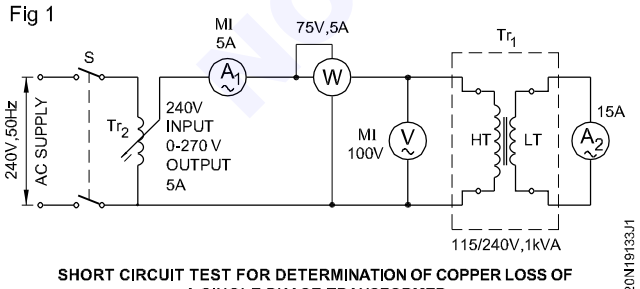
PARTS OF A TRANSFORMER

TASK 2 : **Conduct open circuit test to determine iron or core loss**

1 Identify the LT and HT windings of the given transformer.

2 Connect the Auto-transformer, frequency meter, ammeter, wattmeter. Voltmeter to the LT side of the transformer as shown in Fig 1.

Fig 1



SHORT CIRCUIT TEST FOR DETERMINATION OF COPPER LOSS OF A SINGLE PHASE TRANSFORMER

Ensure that the auto-transformer is initially set at zero volt output position.

3 Close the switch 'S'.

Increase the voltage slowly up to (100%) of the rated value of the transformer L.T.

4 Check for the supply frequency is at rated value.

5 Observe the meters and record the readings in Table.

6 Repeat the above steps for 110% rated value of transformer voltage and record the readings in Table.

TABLE

Sl.No.	Rated	Voltage V	Current A	Total Iron loss W
1	100%			
2	110%			

From the above data the No load loss is equal to iron loss. Since the copper loss is negligible.

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TASK 3: **Conduct shot circuit test to determine full load copper loss of a transformer**

Short circuit test

1 Connect the auto-transformer, ammeters, voltmeter and wattmeter in the HT side of the transformer as shown in Fig 1.

> **Ensure the auto-transformer is initially set at zero volt output position.**

2 Close the switch 'S'

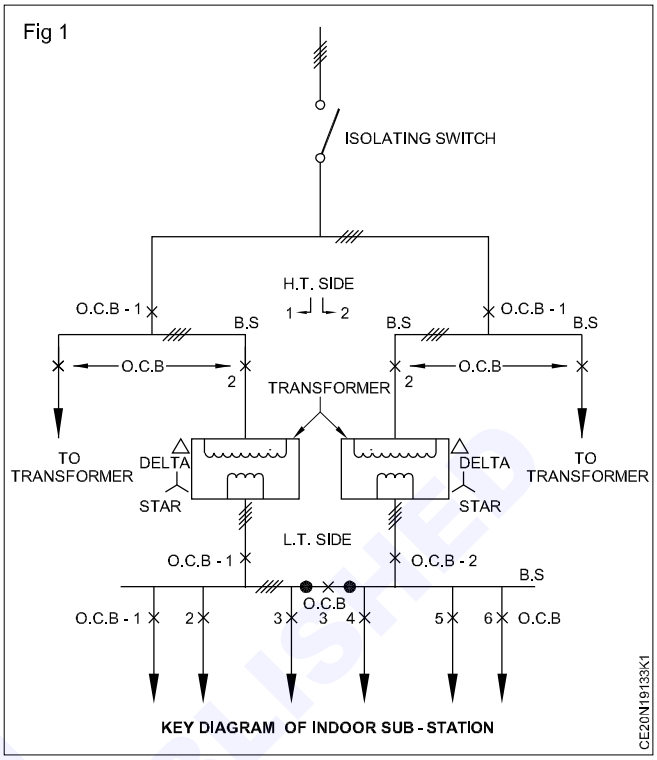
> **The secondary is short circuited by the ammeter.**

3 Increase the voltage gradually to obtain full load current in the secondary winding of the transformer.

4 Observe the wattmeter and record the readings.

W = Copper loss (full load).

Fig 1



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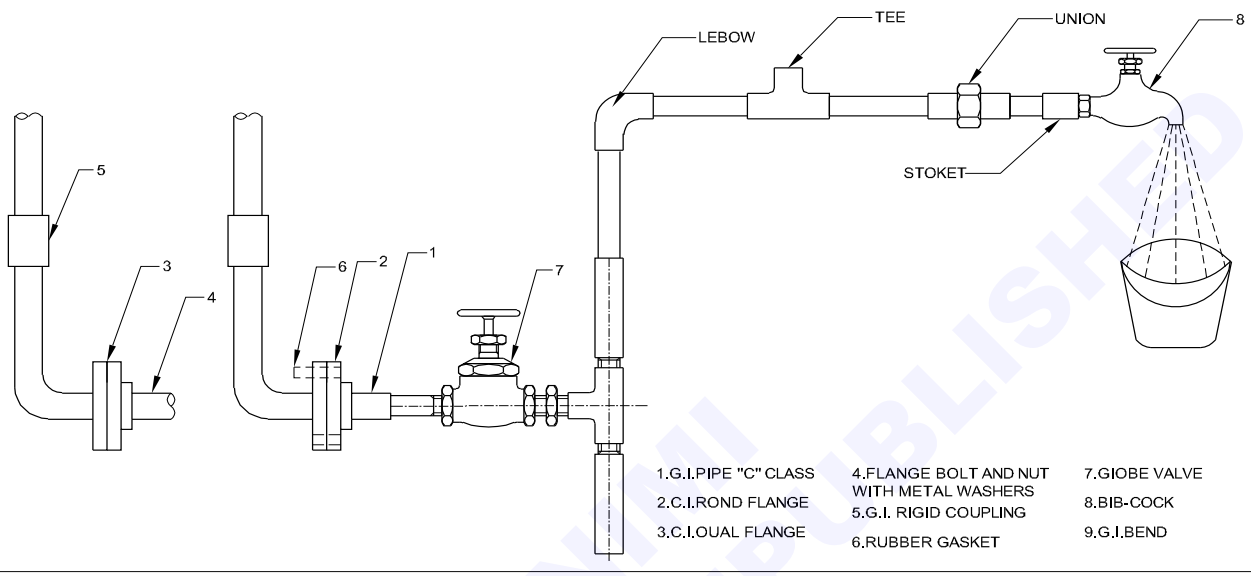
Perform simple pipe connection using G.I pipes with G.I fittings

Objective: At the end of this exercise you shall be able to
- **make simple pipe connection using G.I pipes and G.I fittings .**

PROCEDURE

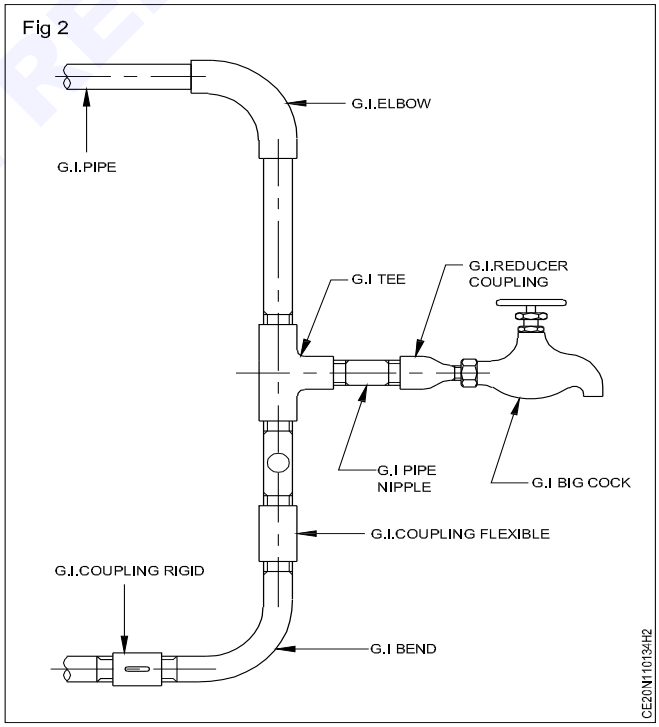
TASK 1: **Make simple pipe connection using G.I pipes and G.I fittings (Fig 1 & 2)**

Fig 1



- Select the appropriate hand tools and materials according to the drawing (Fig 1 & 2)
- Hold the G.I. Pipe and cut the bits to the required size with hacksaw frame blade. (Fig 3)
- File the edges with flat file to remove burrs. (Fig 4)
- Provide BSP threads in the G.I pipe bits with BSP die stock and dies. (Fig 5)
- Threads seal provided using shellac (or) white lead with thread ball. (Fig 6)
- Connect the G.I socket, G.I elbow, G.I, Tee, G.I. Union as per drawing.
- Connect the C.P Bib cock as per drawing
- Clean the work pieces with cotton waste and work places with brush.

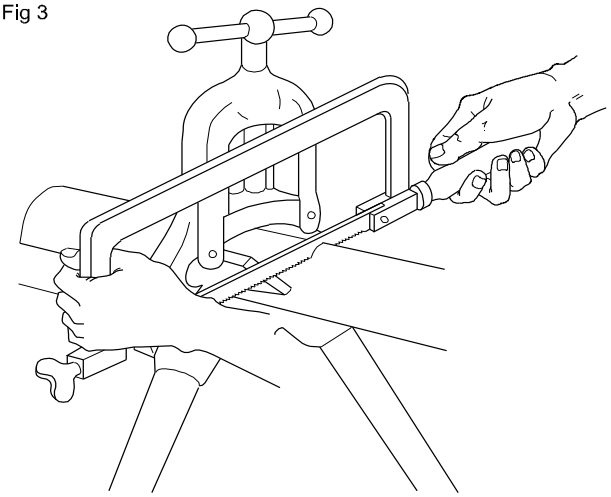
Fig 2



Grip the G.I. pipe into the G.I. fittings up to five thread through hand remaining threads through pipe wrench up to eight threads. While doing threading operation use lubrication oil frequently. Don't overtight the flanges, globe valve and bib-cock exceeding the threads in the fittings.

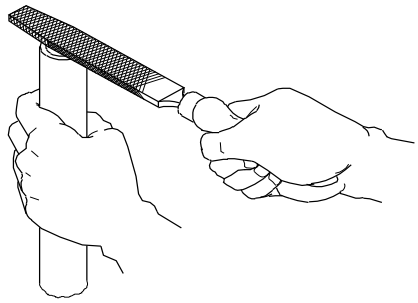
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Fig 3



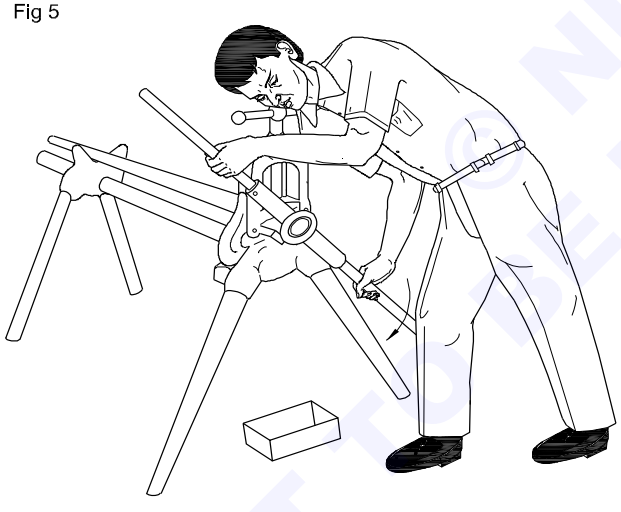
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Fig 4



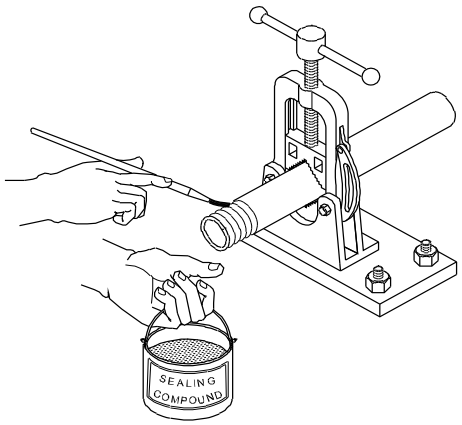
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Fig 5



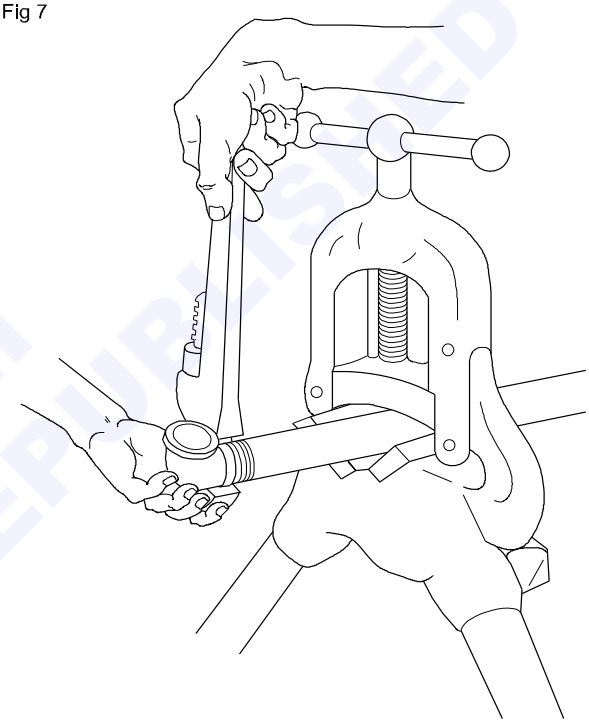
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Fig 6



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Fig 7



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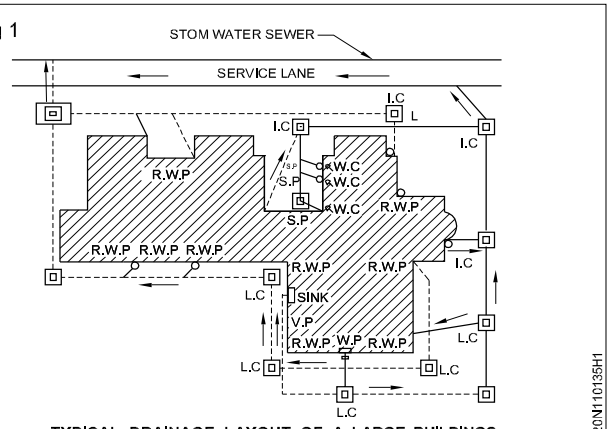
Layout of soil pipe and waste pipe in storied building

Objectives: At the end of the exercise you shall be able to
- **demonstrate the layout of drainage system**
- **demonstrate the rain water and drainage pipe system**
- **demonstrate the process of fixing external soil pipe and waste pipe lines.**

PROCEDURE

TASK 1: **Demonstrate the layout of sanitary system (Fig 1)**

Fig 1



TYPICAL DRAINAGE LAYOUT OF A LARGE BUILDINGS

1 Select the list of material required for the drawing of sanitary plumbing fittings.

2 Check the location of valves, cocks are placed in the correct position.

3 Determine the sizes of pipes for sewage, drain, rainwater etc.

4 Check all the inspection chambers are provided with fresh air inlets.

5 Check the drains are marked as per drawing.

6 Identify the plumbing symbols as per drawing.

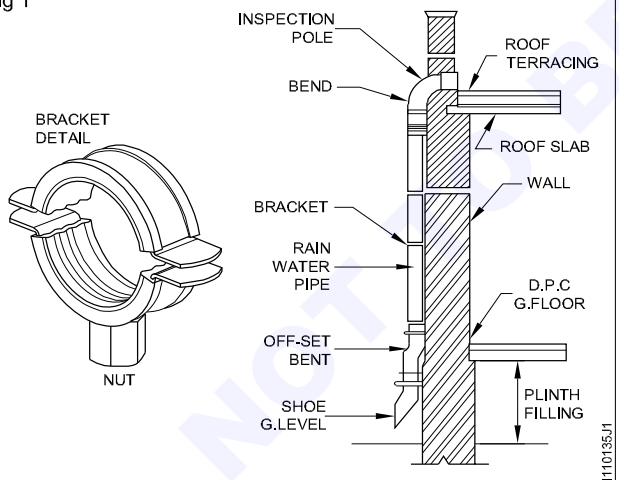
7 Check all soil pipes should be carried direct to the manholes without gully traps as per drawing.

8 Check the drains laid in such a way to ensure their safety in future.

9 Inspect the drains laid in such a way so as to remove the sewage quickly from the building.

TASK 2: **Measure and marking of rain water pipe (Fig 1 & 2)**

Fig 1



PLUMBING WORK OF RAIN WATER PIPE FOR FLAT ROOF

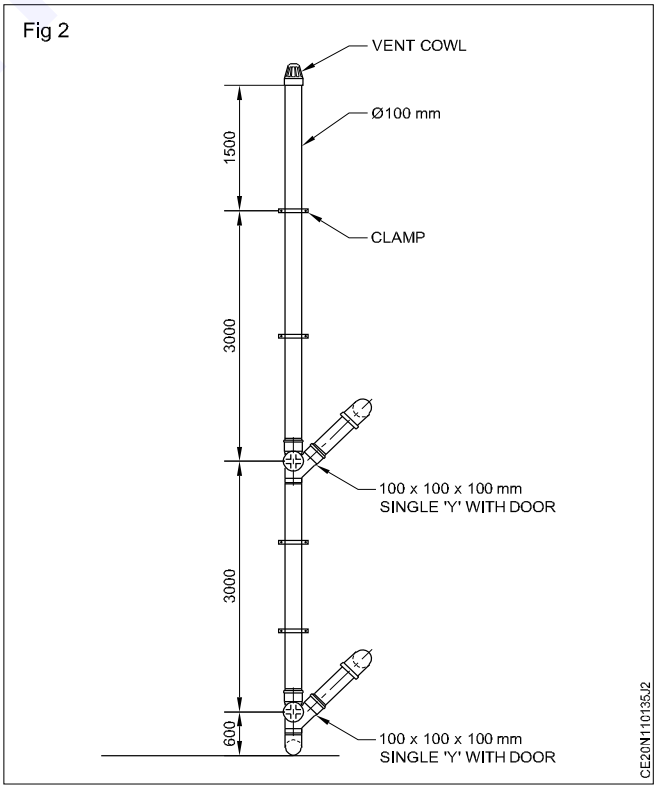
1 Measure and mark out the centre line of the pipe by chalk line & plumb bob.

2 Check the pipe, bend, shoe for visible defects.

3 Fix the bracket

4 Take the measurements of pipe line considering the bend will be inserted in pipe & shoe will be atleast 50mm above the ground level.

Fig 2



5 Make hole in parapet wall larger than bend's outside dia.

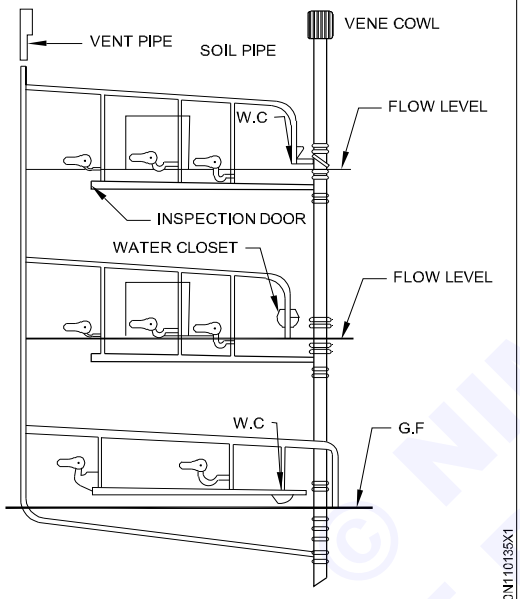
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6 Fix the bend in concrete 1:2:4 at the hole.
7 Cure the concrete
8 Joint the pipes from bottom of bend.
9 Fix bracket loosely
10 Fix shoe to pipe & bracket.
11 Test verticality of pipe with plumb bob.
12 Connect the rain-water pipe to drainage pipe line
13 Test it for leakages.

TASK 3: **Employee process of fixing external soil pipe**

1 Find the line's position.
2 Measure and mark the existing line to trap.
3 Prepare the material required.
4 Connect the trap out let to the required chamber. (Fig 1)

Fig 1

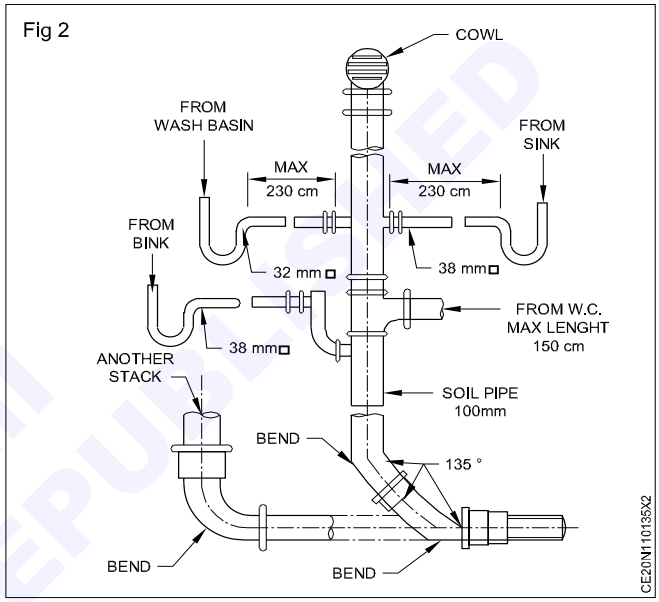


PLUMBING WORK OF ONE PIPE SYSTEM

If need, fittings to be connected to the pipe lines as per the drawing

5 Check the piping system.
6 Check the joint completely (Fig 2)

Fig 2



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Fitting of I.W.C with high level cistern

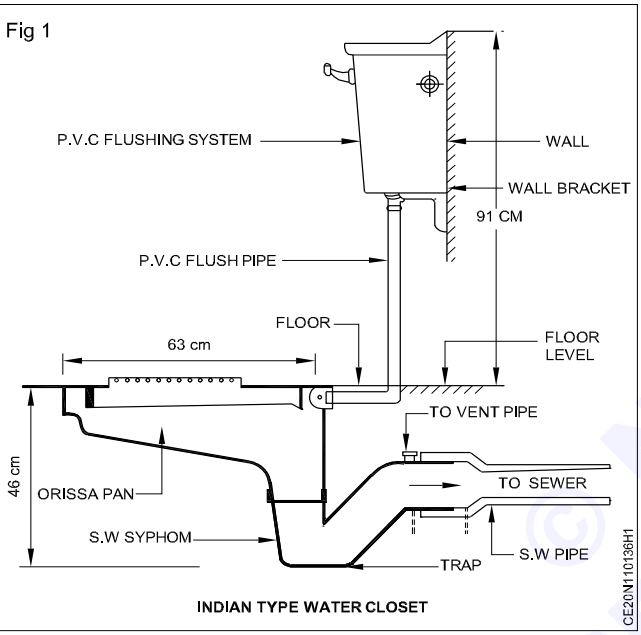
Objectives: At the end of the exercise you shall be able to
- **lay in particular spot**
- **fix the 'S' (or) 'P' trap with existing pipe line**
- **fix the IWC over the trap**
- **fix the flushing cistern with flush pipe.**

PROCEDURE

TASK 1: **Installation of I.W.C**

1 Select the place for IWC.

Fig 1



INDIAN TYPE WATER CLOSET

2 Mark the position for fixing closet, keep the centre line of closet at 90^0 to rear wall.

3 Place the P or 'S' trap in level at required height.

4 Check any visible defects in IWC.

5 Joint the closet and trap using spun yarn soaked in cement paste and cement mortar 1:1.

6 Flush pipe is connected in between high level flush cistern and the inlet of the water closet yoke.

7 Fix foot rest on the shorter arm of the pan on right and left sides.

8 Connect water supply line to the flush tank.

9 Check any leak with water pressure.

Safety

- Handle the closet carefully.
- Fix the trap in perfect level.
- Give minimum gradient to the floor.

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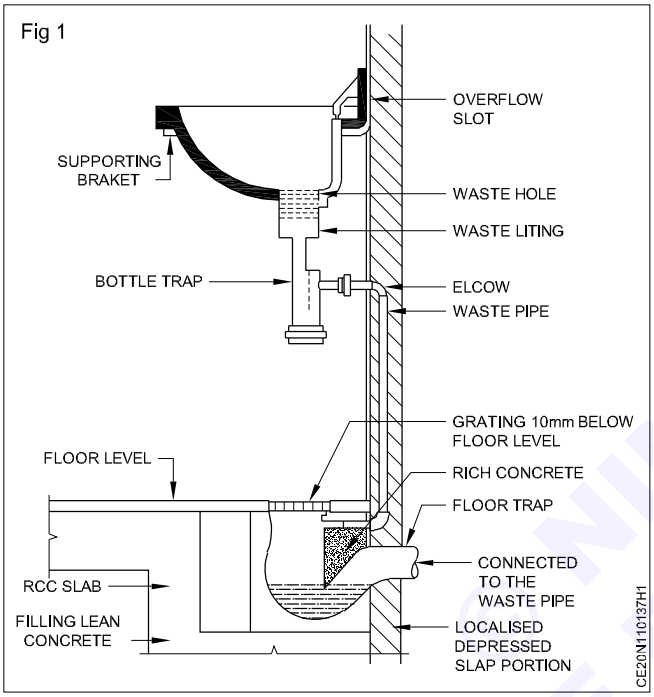
Fitting of wash basin

Objectives: At the end of the exercise you shall be able to
- **mark the height for wash basin**
- **fix wash basin in the wall**
- **connect pillar tap in the wash basin.**

PROCEDURE

TASK 1: **Fitting of wash basin (Fig 1 & 2)**

Fig 1



1 Mark the position of rag bolt at 800mm from floor level.

2 Drill the marked position for rag bolt fixing.

3 Fix the rag bolt at a suitable distance.

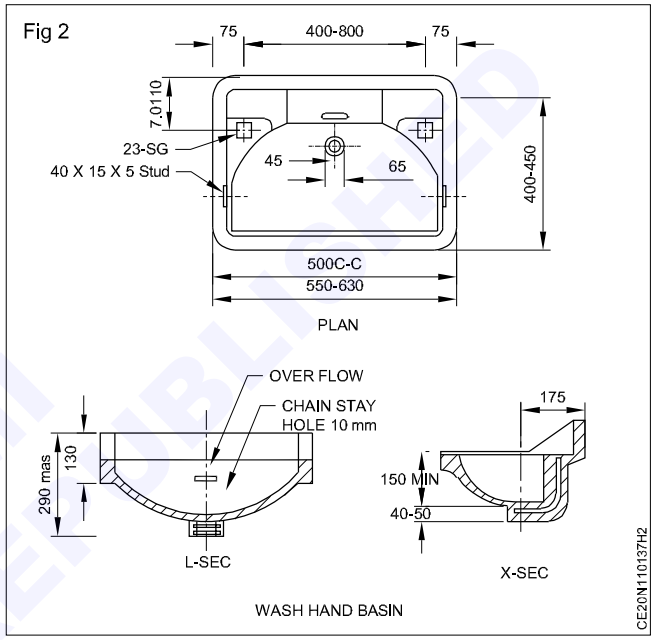
4 Check the wash basin for any visible defects.

5 Assemble the wash basin with pillar tap, waste coupling, rubber plug & chain.

6 Keep the wash basin on the rag bolt.

7 Connect the supply line to pillar tap with flexible connector.

Fig 2



8 Connect bottle trap.

9 Leave the bottle trap to floor trap, semicircular open drain etc.

10 Test the functioning and leakages in joints.

11 Check the wash basin fitting.

Safety

- Handle the wash basin carefully.
- Drill straight & level for rag bolt.
- Use trap in the out let.
- Connect hot water in the left side.

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Fitting of E.W.C with low level cistern

Objectives: At the end of the exercise you shall be able to
- **fitting EWC with low level cistern.**

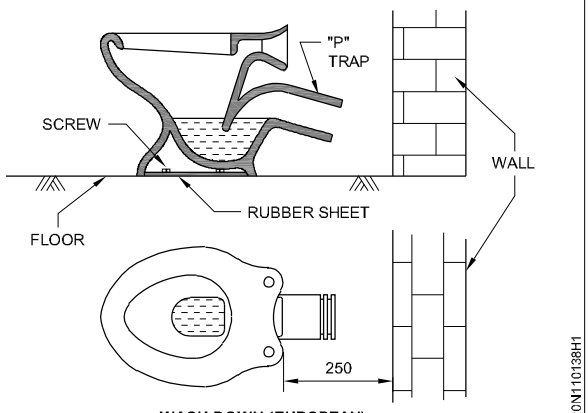
PROCEDURE

TASK 1: **Installation E.W.C**

1 Select the place for EWC.

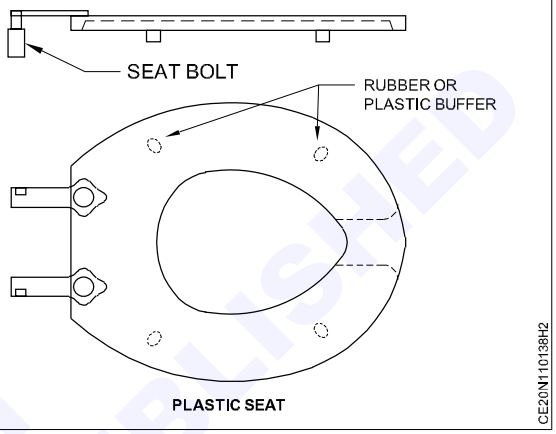
2 Fix the EWC on the floor as shown in (Fig 1)

Fig 1



WASH DOWN (EUROPEAN)

Fig 2



PLASTIC SEAT

3 Fix flushing unit in the wall as shown in the pictures.

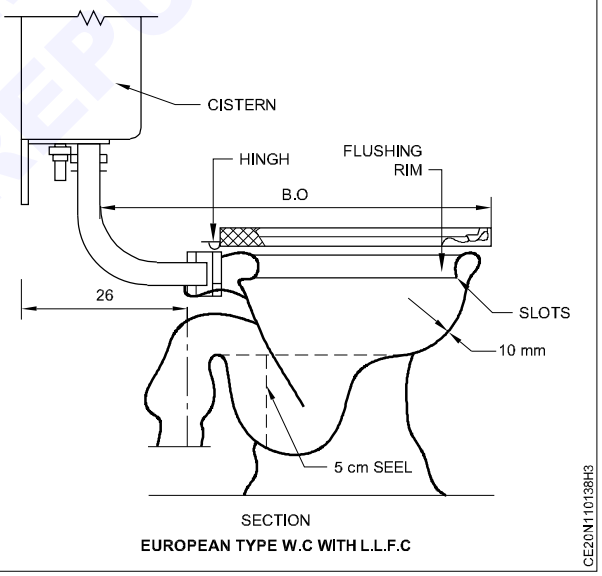
4 With help of an PVC bend and PVC pipe connect to/ EWC.

5 Connect the flush pipe to the inlet opening of EWC and connect the other end to the flush tank. (Fig 3)

6 Check the flush system and EWC for any leak.

7 Fix seat with cover and check the level. (Fig 3)

Fig 3



SECTION
EUROPEAN TYPE W.C WITH L.L.F.C

Safety

- Handle the closet carefully.
- Fix the trap in perfect level.
- Give minimum gradient to the floor.

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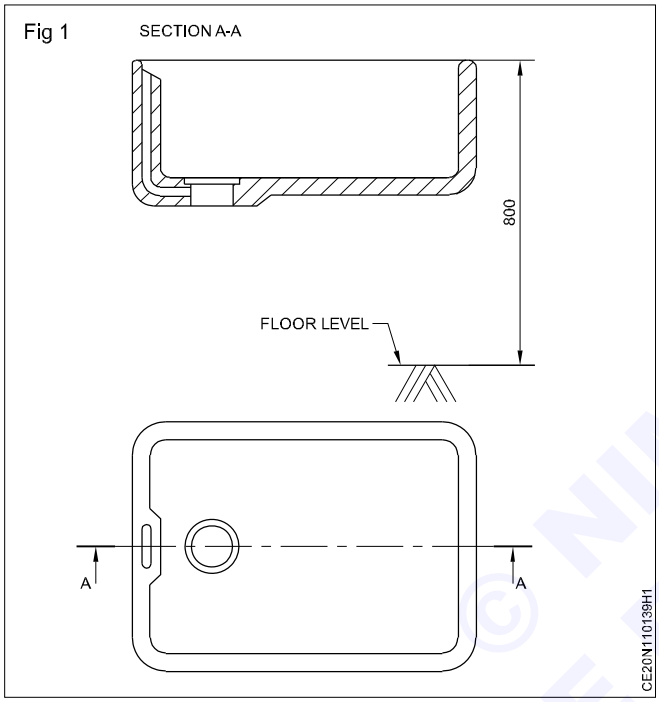
Fitting of kitchen sink

Objective: At the end of the exercise you shall be able to
- **prepare sink for installation**
- **fix sink**
- **provide outlet connection to the sink.**

PROCEDURE

TASK 1: **Installation of kitchen sink. (Fig 1)**

Fig 1



1 Hold sink in position in level. (The height of front edge of sink from the floor level shall be 80cm)

2 Mark the position of bracket.

3 Make a chasing of 100 x 75 x 150cm using chisel etc.

4 Fix C.I cantilever bracket in the chasing using cement concrete 1:2:4.

5 Cure the concrete.

6 Check the sink for any visible defects.

7 Place the sink on the bracket.

8 Connect chromium plated waste coupling to the sink.

9 Connect G.I. or PVC pipe to union and leave it to floor trap.

10 Check the functioning and leakage in joints.

Safety

- Chromium plated coupling should not be over tightened.
- Don't handle acid material in the sink.
- Don't hit (or) strike on sink (or) brackets.

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Fitting of bath tub

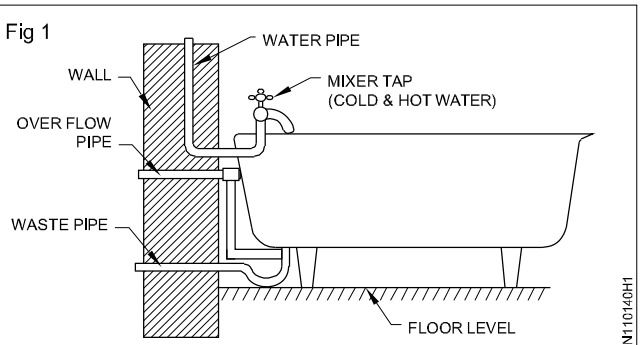
Objective: At the end of the exercise you shall be able to
- **fixing of bath tub.**

PROCEDURE

TASK 1: **Fitting of bath tub**

1 Check the bath tub for any visible defects. (Fig 1)

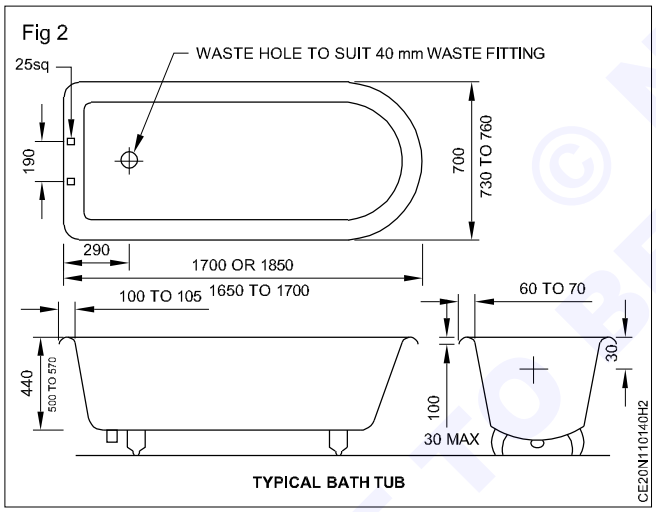
Fig 1



SECTION THROUGH A BATH

2 Place the bath tub at the location specified. Keeping top in level over sand cushion. (Fig 2)

Fig 2



TYPICAL BATH TUB

3 Study the manufactures instruction.

4 Connect the waste pipe to the waste hole.

5 Connect hot & cold water supply line to the tub.

6 Check the functioning after opening the taps.

7 Check the flush system for any leak.

8 Fix the bath tub level to the top level.

9 Connect the hot water line in the left side of the mixture unit.

10 Their should be handles on the top of water level

11 Fix chain with rubber for maintaining.

Safety

- Inside surface of the bath tub to be provided with enamel coating .
- Overflow pipe must be connected before the trap.
- Always to connect left side of the mixer to hot water and right side to cold water.

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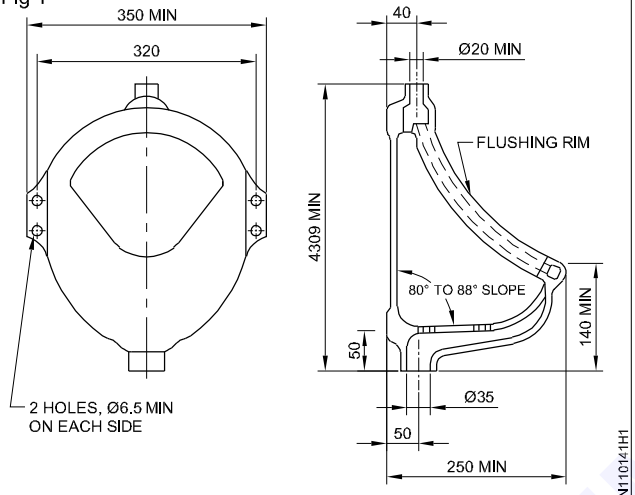
Fitting of urinal pot with cistern

Objective: At the end of the exercise you shall be able to
- **fitting of urinal pot with cistern.**

PROCEDURE

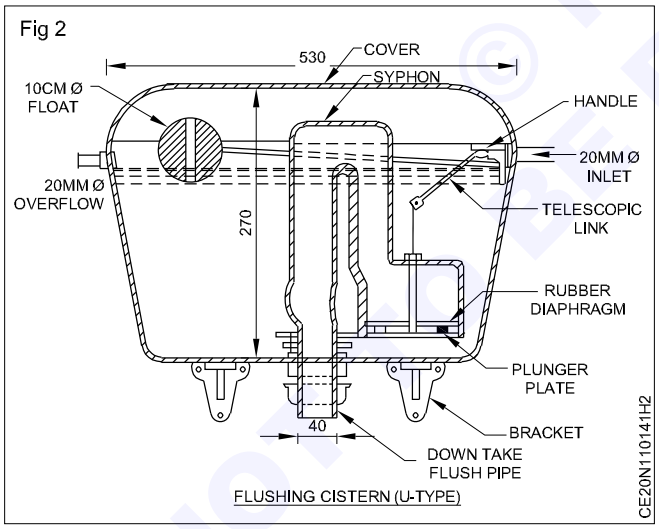
TASK 1: **Fitting of urinal pot with cistern (Fig 1)**

Fig 1



1 Select the place for providing urinal. (Fig 2)

Fig 2



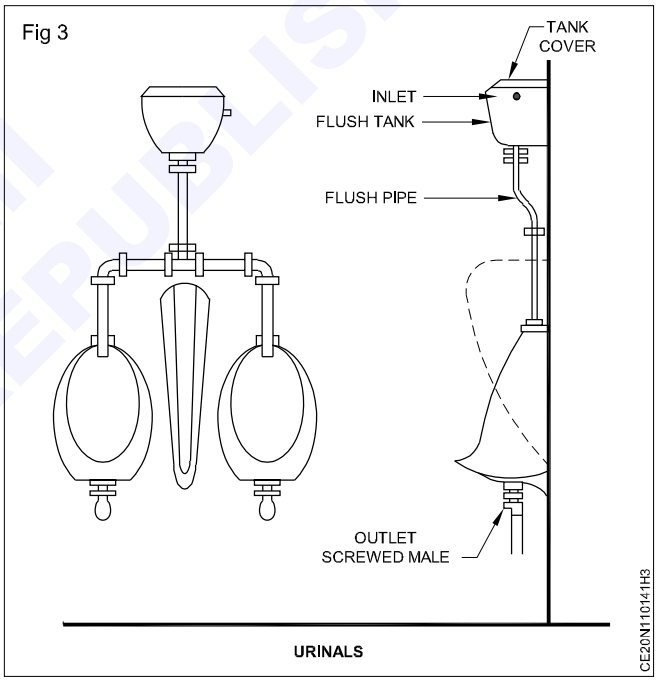
2 Draw the centre line and layout the dimensions on the wall correctly.

3 Bore the wall and fix the wooden plugs to fix suitable screws with cement mortar where it is required.

4 Fix the urinal and the tank on the plug provided with suitable screws.

5 Connect water supply to flushing cistern and check it for any leak. (Fig 3)

Fig 3



Safety

- Handle the urinal carefully.
- Fix the trap and check the level.
- Give minimum gradient to the floor.

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Installing water meter

Objective: At the end of the exercise you shall be able to
- **installing water meter.**

PROCEDURE

TASK 1: **Install water meter in domestic water supply**

1 Arrange proper tools and materials.

2 Close the main line.

3 Mark the position for drilling and tapping on the main line.

4 Drill the main line with ratchet brace.

5 Cut the internal threads with taper pipe tap.

> **Pipe tap is of BSP thread.**

6 Connect the saddle piece on main line.

7 Fit up ferrule to form the necessary connection.

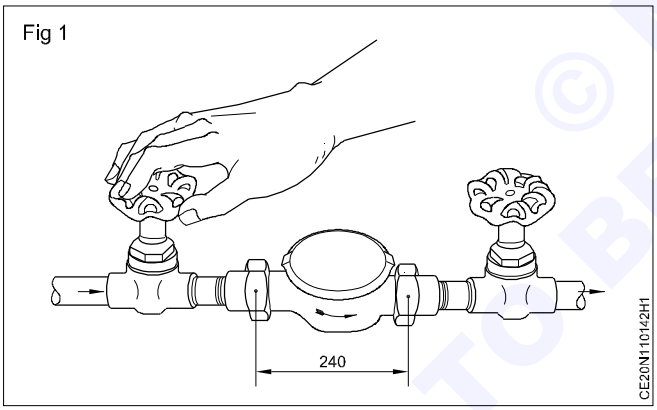
8 Open the valve inside the ferrule and close the cap.

9 Take service pipe on from the saddle piece.

10 Fix a stop cock or gate valve on inlet and outlet of water meter location.

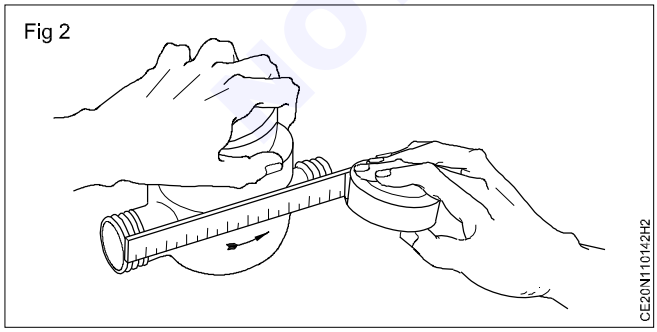
11 Close the stop cocks (Fig 1).

Fig 1



12 Measure the length of water meter and distance between the two unions (Fig 2 & 3).

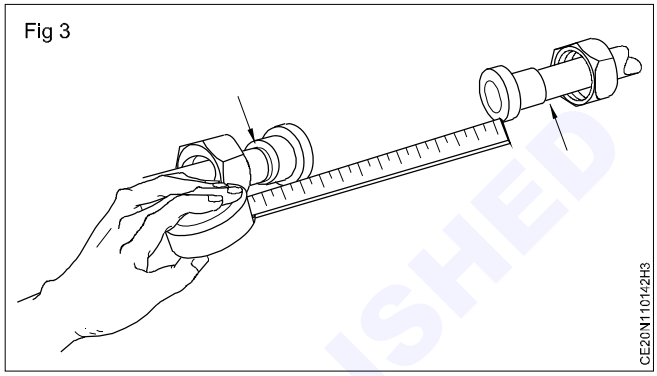
Fig 2



13 Tighten the union to the pipes.

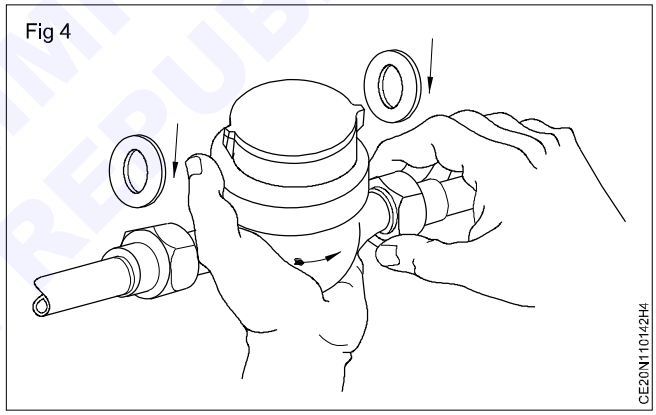
14 Hold the water meter in position between the two union. The direction of flow to coincide with the arrow marked on the water meter.

Fig 3



15 Place a soft leather or rubber washer on one side of the meter (Fig 4)

Fig 4



16 Screw the nut on the coupling.

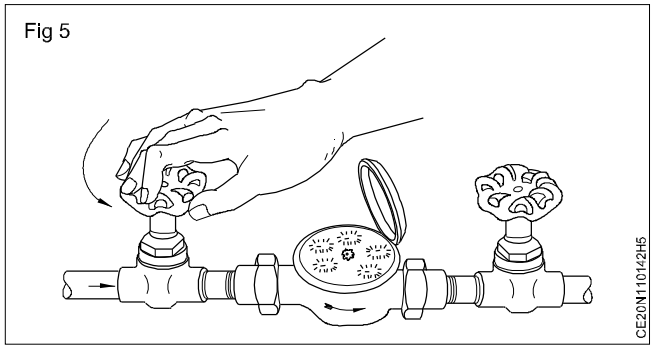
17 Repeat the same procedure for other side.

18 Tighten the coupling nut firmly with a spanner or an adjustable wrench.

19 Open the outlet and inlet valve (Fig 5)

20 Check that the joints are not leaking and the water meter is working (Fig 5).

Fig 5



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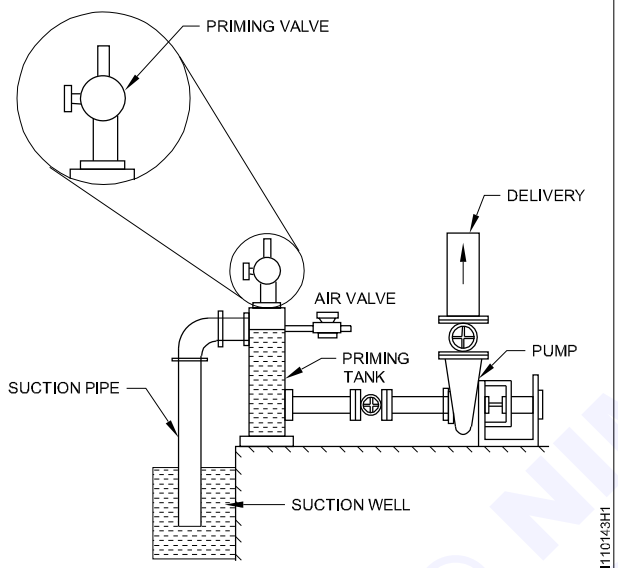
Removal of air locks

Objectives: At the end of this exercise you shall be able to
- **removal of air locks in a pump and main line**
- **removal of air locks in a domestic water line.**

PROCEDURE

TASK 1: **Removal of air locks in a pump (Fig 1)**

Fig 1



PLUMBING WORK OF ONE PIPE SYSTEM

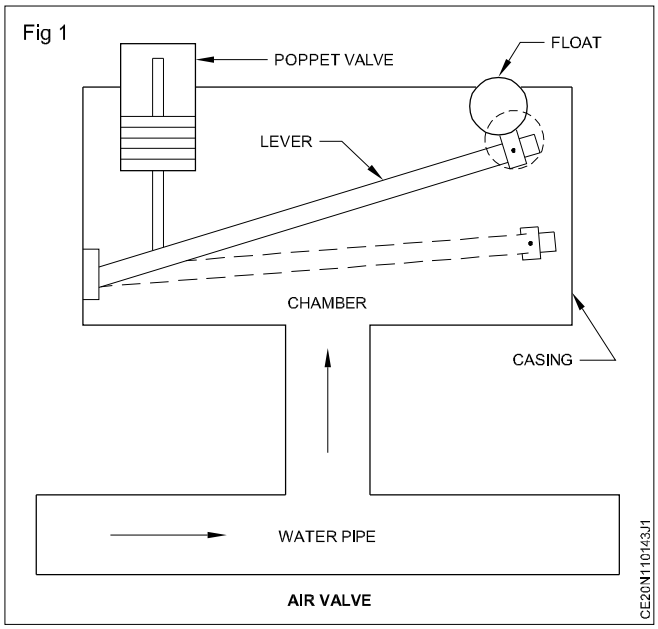
1 Remove the air in the suction line.
2 Open the cap/valve at priming line.
3 Fill the water in the priming line.
4 Open the air lock.
5 Allow the air bubbles fto comes out fully.
6 Close the air lock.
7 Close the cap at priming line.

TASK 2: **Removal of air locks in a main line**

1 Open the valve for flowing the water in the pipe line.
2 Find the quantity of air flow out in the pipe line.
3 Disconnect the fitting to the nearest point. (highest pipe-line portion)
4 Modify inspection chamber.
5 Fix the air relief valve at inspection chamber.
6 Air relief valve to release the air lock in the pipe line, air goes at the top of pipes.
7 Air relief valve chamber.

Value may not be properly functioning due to ball may worn out (or) rubber flange may worn out. If needed replace it.

Fig 1



AIR VALVE

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P.H meter - treatment of effluent water

Objectives: At the end of the exercise you shall be able to
- **prepare the water and analysis kit**
- **testing PH values, TDS and temperature.**

PROCEDURE

Instructor shall display and demonstrate to the students regarding the PH by PH meter and analysis and treatment of effluent water.

TASK 1: **Analysis and treatment of effluent water**

1 Prepare the water analysis kit.

2 Testing the temperature of water by shielded thermometer.

3 Testing the PH value of water.

4 Testing the TDS and salinity contents in the water. (Fig 1)

5 Testing the dissolved oxygen contents in the water.

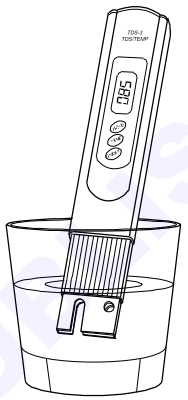
6 Testing the turbidity contents.

7 Testing the B.O.D contents.

8 Testing the total coliform bacteria in water.

9 Use protective clothes before commencing the test.

Fig 1



CE20N110144H1

Test 1:	Temperature	Shielded thermometer
Test 2:	PH	2 test tubes with caps. 50 ml wide range indicator
Test 3:	Dissolved oxygen	Sampling bottle 25 ml of manganous sulphate 25 ml of alkaline potassium iodide oxide 25 ml of sulfuric acid 25 ml of starch indicator solution 50 ml of sodium thiosulfate Titration tube with cap Titrator
Test 4:	BOD	5 additional DO sampling bottles
Test 5:	Nitrates	Plastic sampling bottle 100 ml mixed acid agent Nitrate reducing agent (powder) 1g measuring spoon

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Recondition (repairing) caps, valves & flushing tank

Objectives: At the end of the exercise you shall be able to
- **repair and reassemble water tap**
- **repair and reassemble gate value**
- **repair and reassemble flushing tank.**

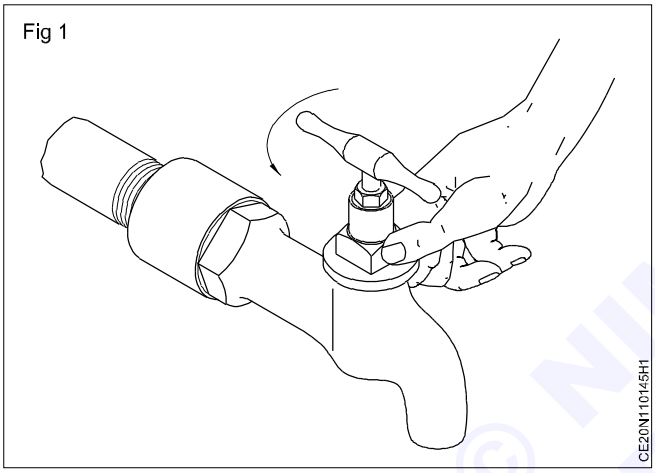
PROCEDURE

TASK 1: **Repairing of water tap replacing of washer**

1 Shut off the water supply by closing the main stopcock or the main gate valve.

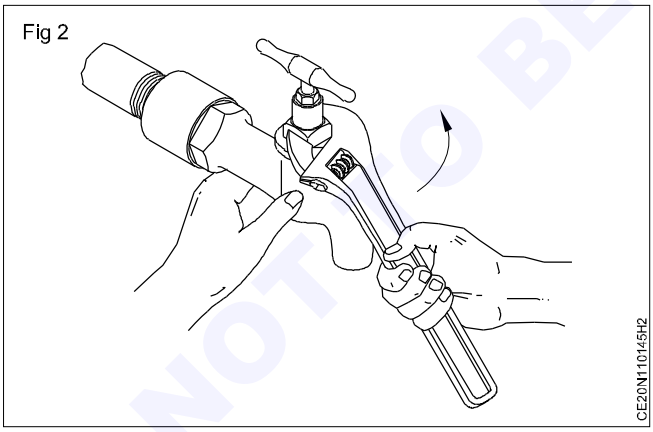
2 Keep the water tap to be repaired in the “open” position. (Fig 1)

Fig 1



3 Remove the bonnet from the water tap with a spanner (Fig 2).

Fig 2



4 Inspect the washer for damage (Fig 3).

5 Hold the metal disk plate with a pliers and unscrew washer nut with a spanner (Fig 4).

6 Remove the washer from its seating.

7 Press the new washer into position.

Use fiber washer for hot water tap.

8 Refit the washer nut and tighten it firmly (Fig 4).

Fig 3

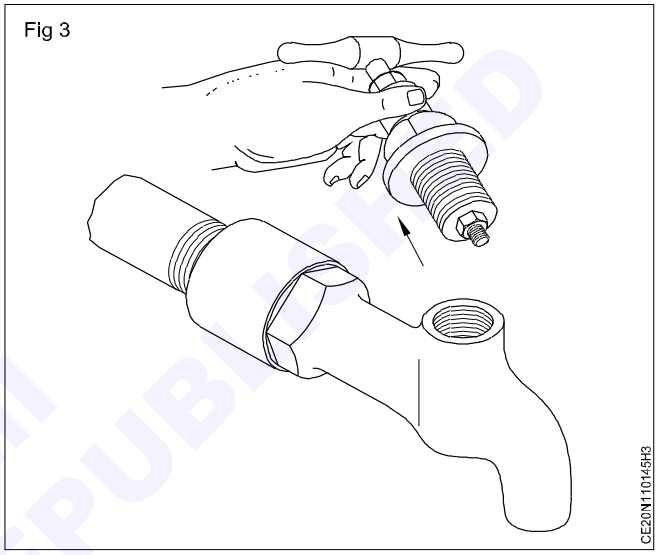
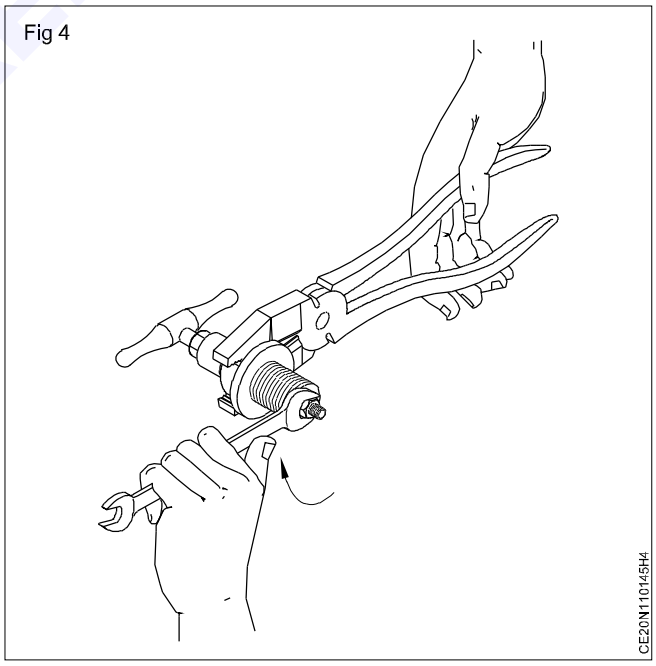


Fig 4

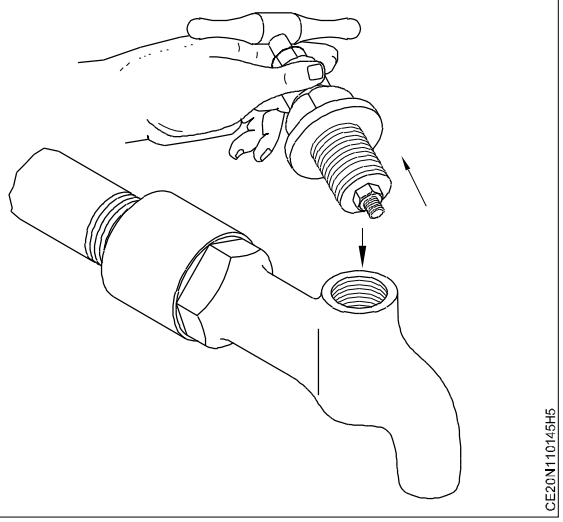


9 Replace the repaired bonnet into the water tap (Fig 5). Tighten the bonnet with a wrench. Do not overtighten it as this would damage the thread of the water tap body.

10 Open the main gate value and test the water tap for leakage.

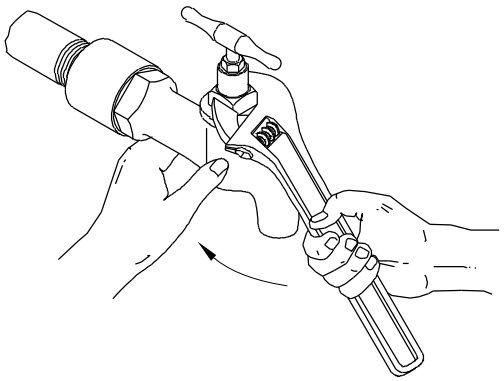
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Fig 5



CE20N1110145H5

Fig 6

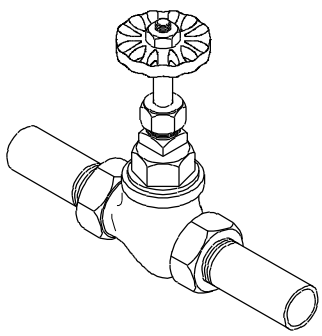


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TASK 2: **Repair a gate valve**

1 Close the gate-valve by turning the hand wheel clockwise (Fig 1).

Fig 1



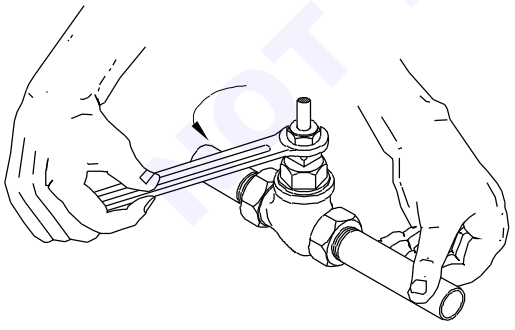
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This will stop the water in the valve to be repaired.

2 Remove the nut with a spanner and lift off the wheel.

3 Remove the gland nut from the bonnet by turning it in the anticlockwise direction (Fig 2).

Fig 2



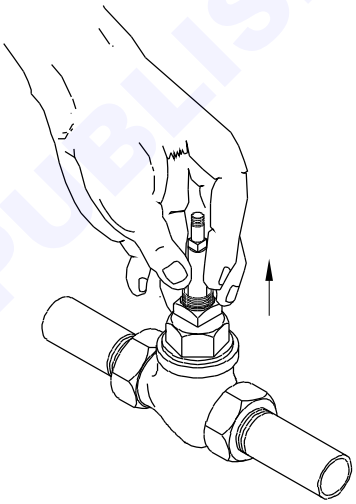
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4 Remove the stuffing gland (Fig 3).

5 Clean out the old packing in the stuffing box

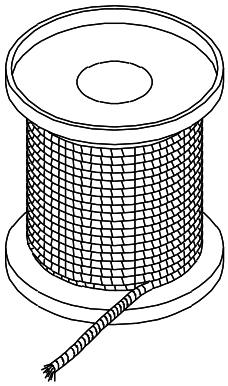
6 Cut a strand of asbestos rope to make a new packing. (Smear it with water pump grease or graphite paste) (Fig 4)

Fig 3



CE20N1110145J3

Fig 4



CE20N1110145J4

7 Coil the new packing round the shaft and push it down with a screwdriver (Fig 5).

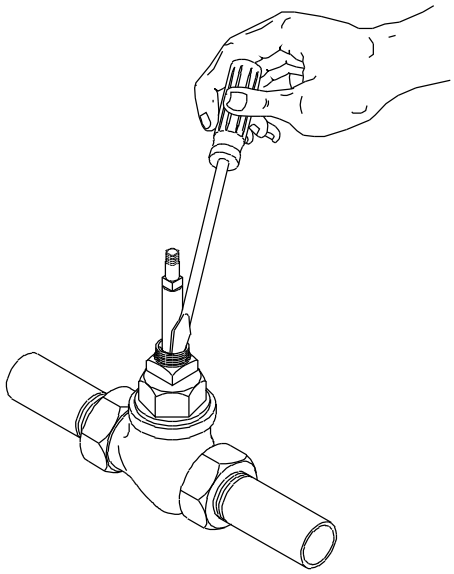
8 Push in the stuffing gland and check that it fits tightly in the stuffing box.

9 Re-assemble and leave the gland nut hand tight.

10 Assemble the hand wheel and tighten the hand wheel nut (Fig 6).

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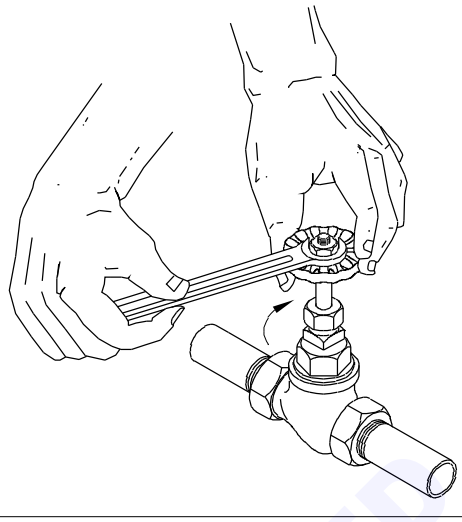
Fig 5



CE20N110145J5

11 Open the gate-valve and tighten the gland nut until the packing is compressed sufficiently to stop the water escaping from the gland nut.

Fig 6



CE20N110145J6

Removal of spindle set and gate part.

Hold the spanner at bonnet neck.

Loose the bonnet two or three turn again close the bonnet 2 or 3 turn

TASK 3: **Repairing of flushing cistern**

1 Turn off the water supply to the flushing cistern by closing stop cock.

2 Find out the water level when full and level of over flow pipe.

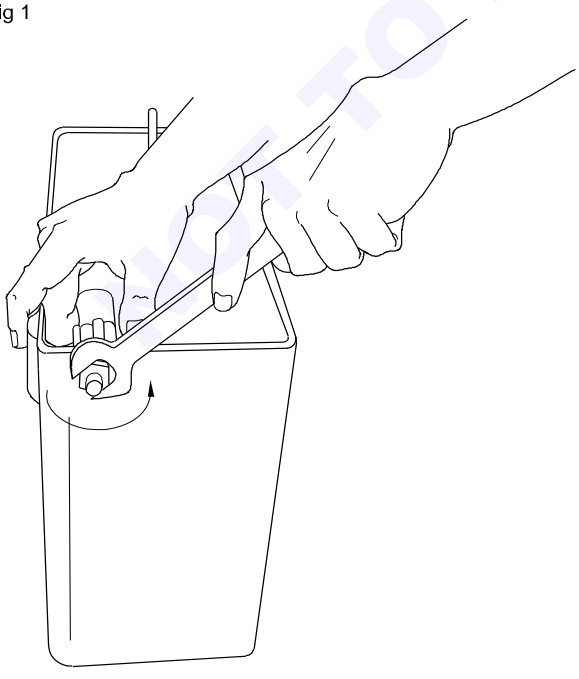
3 Flush the cistern to drain water spout.

4 Mope inside with a sponge or cloth.

5 Remove the flexible pipe from cistern using pipe wrench.

6 Unscrew the ball cock and remove it. (Fig 1)

Fig 1



CE20N110145X1

7 Check the condition of valve, washer, lever arm etc;

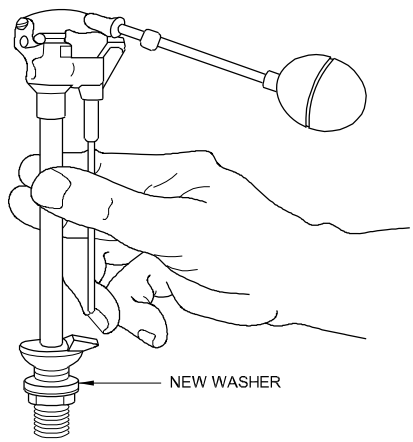
If it is beyond repair replace the seat with new one.

8 Tighten the lock nut with finger at bottom.

9 Tighten the check nut of flexible pipe to cistern.

10 Check the ball valve for free movement. (Fig 2)

Fig 2



CE20N110145X2

11 Turn on water supply.

12 Check the leakage at out let and inlet.

13 Check proper function. (Fig 3)

14 Bend the float arm down if water level is high. ie above from the required level. (25mm below overflow level) (Fig 4)

15 Bend the rod up if the water level is low.

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Fig 3

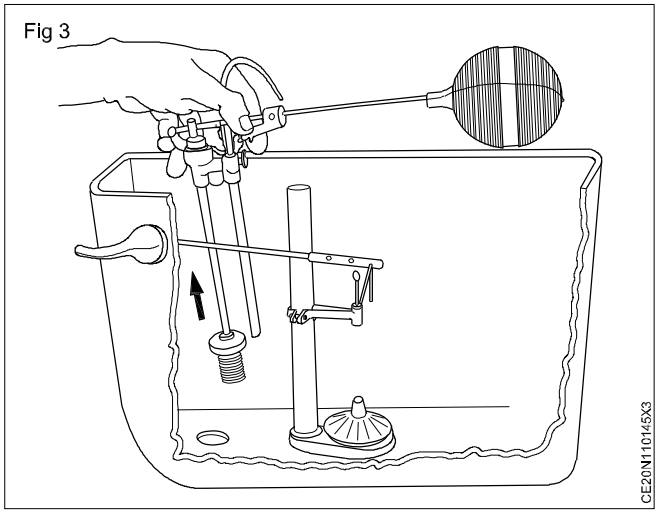
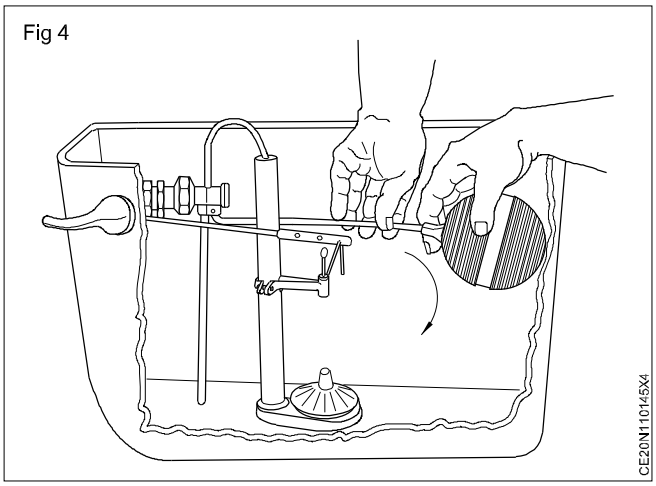


Fig 4



Safety

- Use proper tools
- Float value removal only by spanner.

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Preparing a water supply system in a residential building

Objectives: At the end of this exercise you shall be able to
- **laying of distribution line as per drawing**
- **connect existing line to consumer line.**

PROCEDURE

TASK 1: **Laying of distribution line**

1 If required area to be excavated.

2 Lay the pipe to existing line to underground water tank (sump) and fix float valve.

3 Erect the motor at sump with suction & delivery line if required with valves & fittings.

4 Connect delivery line from the sump to overhead tank with required fittings.

5 Provide separate water line for each floor with required fittings.

— — — — — — — —

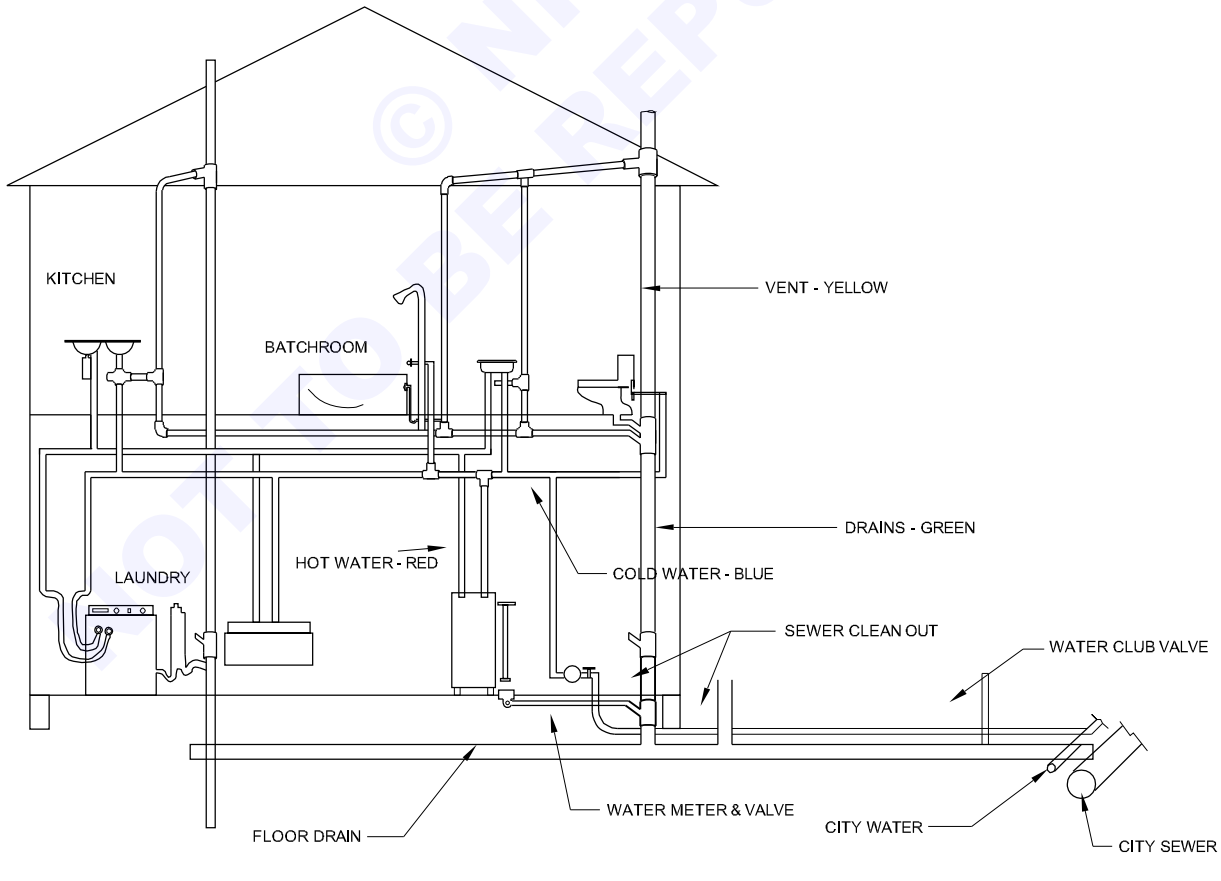
TASK 2: **Connecting of consumer line**

1 Laying the separate line for branching with required fittings.

2 Connect branching to separate line for each floor with hand pumps.

3 Connect communication line to consumer line with stop cock & water meter. (Fig 1)

Fig 1



— — — — — — — —

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Different objects on 3D modelling concept in CAD

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

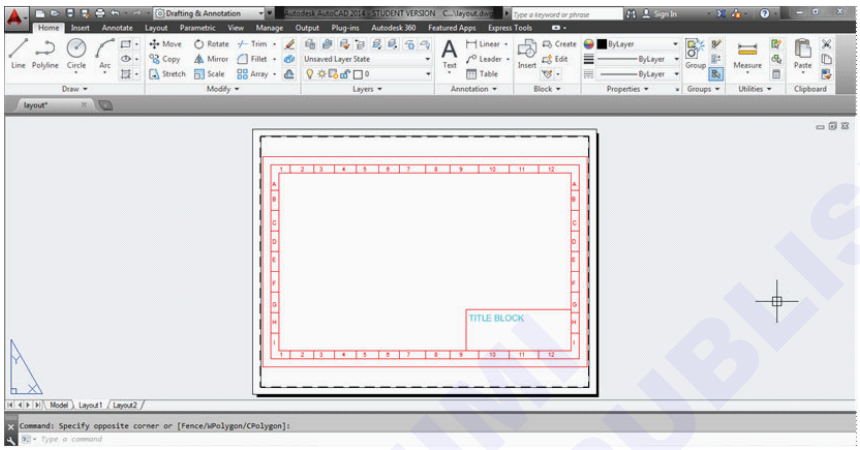
PROCEDURE

TASK 1: **Creating a engineering layout**

1 Follow the CAD commands and complete the lay out as given in figure. (Fig 1)

2 Create a standard engineering layout.

Fig 1



Create and edit wire frame model

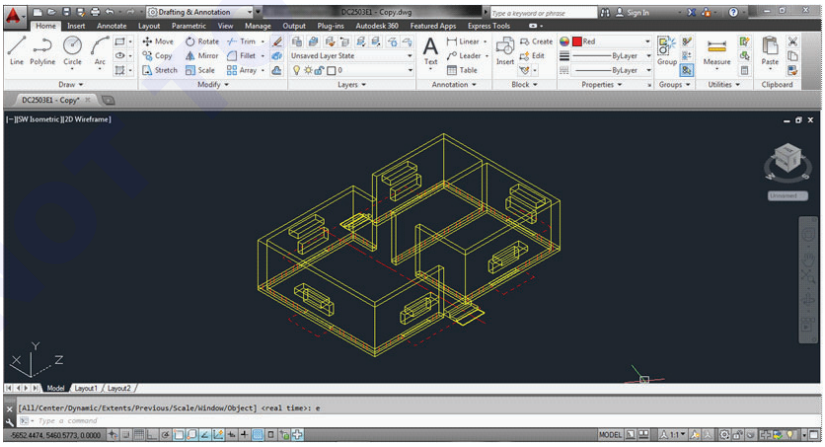
Objectives: At the end of this exercise you shall be able to
- **creating and editing a wire frame.**

TASK 1: **Create a wire frame model and edit it**

1 Follow the CAD commands to create the wire frame model given. (Fig 1)

2 Create and edit wireframe model.

Fig 1



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Create and edit solid mesh and surface modeling

Objective: At the end of this exercise you shall be able to

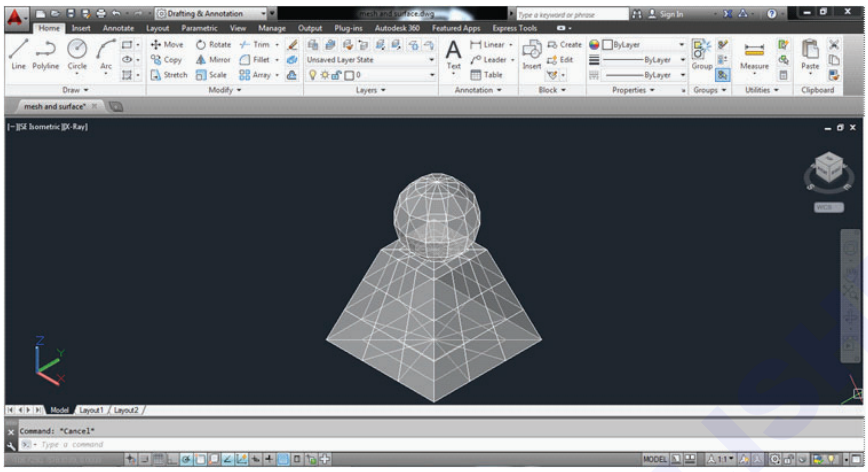
- **create and editing a solid mesh and surface.**

TASK 1: **Creating a solid mesh and editing and surface modeling**

1 Use CAD commands to create the models and for editing.

2 Create and edit solid mesh and surface modeling.

Fig 1



Create and edit simple 2D region and 3D solid model

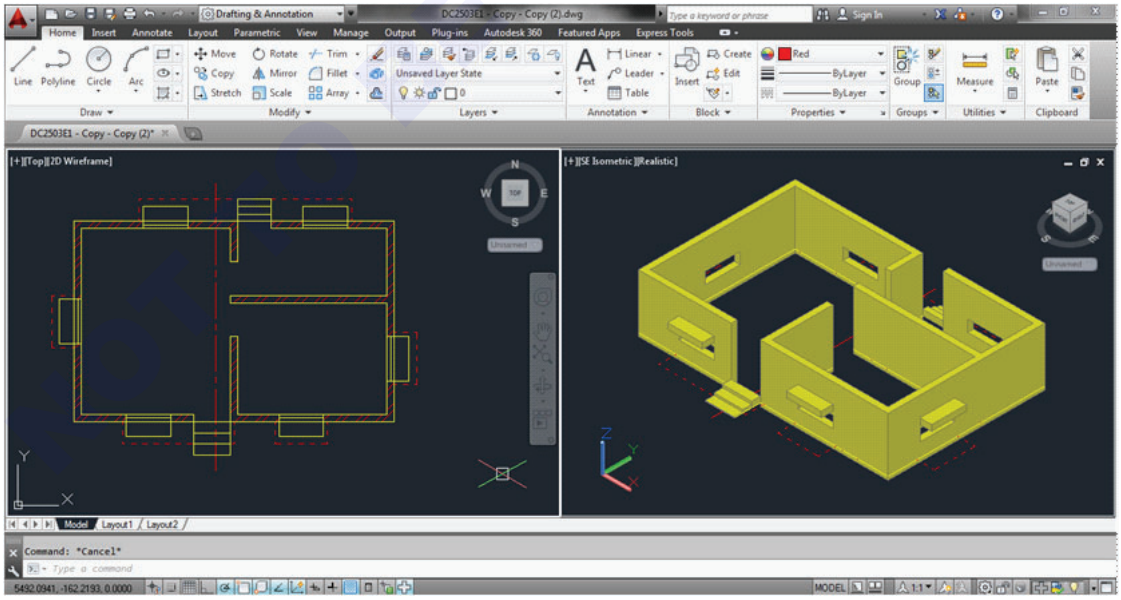
Objective: At the end of this exercise you shall be able to

- **creating and editing a 2D region and 3D solid model.**

TASK 1: **Creating a 2D drawing and draw the same in 3D**

1 Create and edit simple 2D regions and 3D solid models. (Fig 1)

Fig 1



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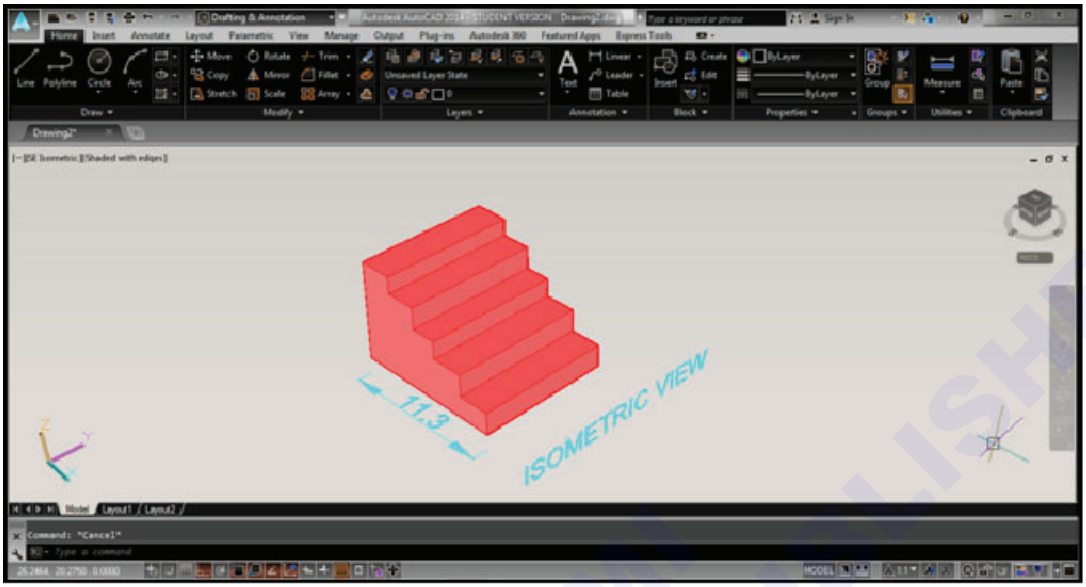
Generate 3D text and dimensions

Objective: At the end of this exercise you shall be able to
- **generate 3D text and 3D dimension display.**

TASK 1: **Generate a 3D Text and dimensions using 3D display techniques**

1 Generate 3D text and dimension using a variety of 3D display techniques. (Fig 1)

Fig 1



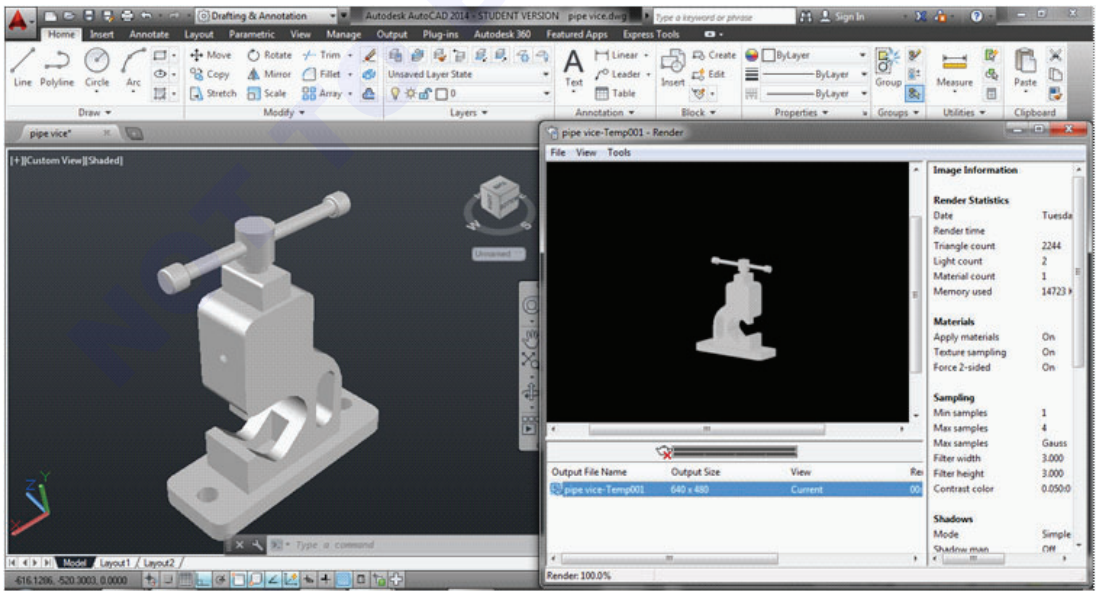
3D model with lights and materials

Objective: At the end of this exercise you shall be able to
- **rendering a 3D model with lights.**

TASK 1: **Prepare a 3D model with lights**

1 Render a 3D model with a variety of lights and materials. (Fig 1)

Fig 1



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