DRAUGHTSMAN CIVIL

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

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

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

Post Box No. 3142, CTI Campus, Guindy, Chennai - 600 032

Sector : **Construction**

Duration : **2 Years**

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

Developed & Published by

National Instructional Media Institute
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Guindy, Chennai - 600 032
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Website: www.nimi.gov.in

First Edition : September 2022 Copies : 1000

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

Jai Hind

SHRI. ATUL KUMAR TIWARI., I.A.S.,
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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 syllabi (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 NCVT/NAC in India, which is to help an individual to master skills to do a job. The instructional materials are generated in the form of Instructional Media Packages (IMPs). An IMP consists of Theory book, Practical book, Test and Assignment book, Instructor Guide, Audio Visual Aid (Wall charts and Transparencies) and other support materials.

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

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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ACKNOWLEDGEMENT

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 **Draughtsman Civil** (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

The trade practical manual is intended to be used in workshop . It consists of a series of practical exercises to be completed by the trainees during the course of the **Draughtsman civil** trade supplemented and supported by instructions/ informations to assist in performing the exercises. These exercises are designed to ensure that all the skills in compliance with NSQF LEVEL - 4 (Revised 2022).

Module 1 - Safety

Module 2 - Basic Engineering Drawing

Module 3 - Masonry

Module 4 - Foundation

Module 5 - Temporary Structure

Module 6 - Treatment for Building

Module 7 - Arches and Lintels

Module 8 - Chain surveying

Module 9 - Compass surveying

Module 10 - Plane table surveying

Module 11 - Carpentry

Module 12 - Electrical wiring

Module 13 - Floors

Module 14 - Vertical movements

Module 15 - Pitched roof

Module 16 - Leveling

Module 17 - Theodolite survey

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 **Draughtsman civil** Trade. 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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LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

Sl.No.	Learning Outcome	Exercise No.
1	Draw free hand sketches of hand tools used in civil work following safety precautions.	1.1.01 - 08 & 1.2.13
2	Draw plane figures applying drawing instruments with proper layout and folding of drawing sheets.	1.2.14 - 1.2.16
3	Construct plain scale, comparative scale, diagonal scale and vernier scale.	1.2.17
4	Draw orthographic projections of different objects with proper lines, lettering and dimensioning.	1.2.18 - 1.2.21
5	Draw Isometric, oblique and perspective views of different solid, hollow and cut sections with proper lines and dimensions as per standard convension.	1.2.18 - 1.2.21
6	Draw component parts of a single storied residential building with suitable symbols and scales.	1.3.22
7	Draw different types of stone and brick masonry.	1.3.23 & 1.3.24
8	Draw different types of shallow and deep foundation.	1.4.25 - 1.4.30
9	Draw different types of shoring, scaffolding, underpinning, form work and timbering.	1.5.31 - 1.5.34
10	Drawing of different types of damp proofing in different position.	1.6.35 - 1.6.37
11	Drawing of different types of arches and lintels with chajja.	1.7.38 - 1.7.40
12	Perform site survey with chain / tape and prepare site plan.	1.8.41 - 1.8.45
13	Perform site survey using prismatic compass and prepare site plan.	1.9.46 - 1.10.51
14	Perform site survey with plane table and prepare a map.	1.10.52
15	Drawing of different types of carpentry joints.	1.11.53 - 1.11.54
16	Draw different types of doors and windows according to manner of construction, arrangement of component, and working operation	1.11.55
17	Prepare the detailed drawing of electrical wiring system.	1.12.56 & 1.12.57
18	Draw types of ground and upper floors.	1.13.58 & 1.13.59
19	Draw different types of vertical movement according to shape, location, materials by using stair, lift, ramp and escalator.	1.14.60 - 1.14.62
20	Draw different types of roofs, truss according to shape, construction, purpose and span	1.15.63 - 1.15.65
21	Make topography map by contours with levelling instruments.	1.16.66 - 1.16.81
22	Perform a site survey with theodolite and prepare site plan.	1.17.82 - 1.17.90

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SYLLABUS FOR DRAUGHTSMAN CIVIL

Duration: Two Year

Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 56Hrs; Professional Knowledge 14Hrs	Draw free hand sketches of hand tools used in civil work following safety precautions.	1. Importance of trade training, demonstrate tools &equipments used in the trade.(02 hrs) 2. Importance of housekeeping & good shop floor practices. (02 hrs) Occupational Safety & Health : 3. Introduction to safetyequipmentsand their uses. Introduction of first aid. Health, Safety andEnvironment guidelines, legislations & regulations as applicable.(04 hrs) 4. Disposal procedure of wastematerials of the trade. (03hrs) 5. Personal protective Equipments (PPE):- Basic injuryprevention, Basic first aid. (04hrs) 6. Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. (03hrs) 7. Preventive measures forelectrical accidents & Carpenter works :- steps tobe taken insuchaccidents. (02 hrs) 8. Use of Fire extinguishers.(08hrs)	• Importance of safety and general precautions observed in the 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. (07 hrs.)
		9. Awareness about the job-sheets made by the ex. Trainees. (02hrs) 10. Use of drawing instruments and equipment with care. (03hrs) 11. Method of fixing of drawing sheet on the drawing board. (03hrs) 12. Layout of different size ofDrawing sheets and foldingof sheets. (06hrs) 13. Draw free hand sketch of hand tools used in civil work.(14hrs)	• 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. (07 hrs.)
Professional Skill 56Hrs; Professional Knowledge 12Hrs	Draw plane figures applying drawing instruments with proper layout and folding of drawing sheets.	14. Symbols & conventional representation for materials in sections as per IS 962-1989, SP-46:2003 for buildingdrawings. (15hrs) 15. Lines, lettering andDimensioning. (24hrs) 16. Construction of plaingeometrical figures. (17hrs)	• Importance of B.I.S. • Introduction of Code for practice of Architectural and • Building Drawings (IS: 962-1989, SP-46:2003). • Layout of drawing. Lines, Lettering, Dimensioning. (12 hrs.)

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Professional Skill 28Hrs; Professional Knowledge 06Hrs	Construct plain scale, comparative scale, diagonal scale and vernier scale.	17. Drawing of:-Construction of scales - Plain, comparative, diagonal, vernier& scale of cords. (28hrs)	• Knowledge of different types of scale. Principle of R.F. 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. (06 hrs.)
Professional Skill 56Hrs; Professional Knowledge 12Hrs	Draw orthographic projections of different objects with proper lines, lettering and dimensioning. Draw Isometric, oblique and perspective views of different solid, hollow and cut sections with proper lines and dimensions as per standard convension.	Drawing of :- 18. Three views in OrthographicProjection of Line, plane, Solid objects& section of solids. (18hrs) 19. Isometric Projection of geometrical solids. (10hrs) 20. Construction of solid geometrical figures. (10hrs) 21. Oblique and Perspective views of step block. (18hrs)	• Different types of projection views: Orthographic, Isometric, Oblique and Perspective. Building materials:- • Sand:-characteristics, types&uses. • Clay Products :- types, earthenware, stoneware, porcelain, terracotta, glazing. • Mortar&Concrete:-Types,uses, preparation, proportion, admixtures and applications. (12 hrs.)
Professional Skill 28Hrs; Professional Knowledge 06Hrs	Draw component parts of a single storied residential building with suitable symbols and scales.	Drawing of :- 22. Component parts of a single storied residential building. (in sectional details)Showing Foundation, Plinth, Doors, Windows, Brick work, Roof, Lintel and Chajjah, etc. (28hrs)	Building materials:- • Timber:- Types, Structure, disease & defects, characterstic, seasoning, preservation and uitility. • Alternaative material to Timber • Plywood, Block board, Particle board, Fireproof reinforced plastic(FRP), Medium density fireboard (MDF) etc. • Tar, bitumen, asphalt:- • Properties, application and uses. (06 hrs.)
Professional Skill 56Hrs; Professional Knowledge 12Hrs	Draw different types of stone and brick masonry.	23. Draw Details of stone masonryincluding stone joints. (26hrs) 24. Drawing of :-Different types of brick bondingShowing arrangement of bricks in different layers as per thickness of wall, pillars, copying, etc. (30hrs).	Protective materials:- • Paints:- characteristic, types, uses. • Varnishes :- characteristics and uses. • Metal:- characteristic, types, uses.

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			• Plastics :- characteristic, types, uses. Building Construction:- • Sequence of construction of a building. • Name of different parts of building. • Stone masonry:- • Terms, use and classification. • Principle of construction, composite masonry. • Strength of walls. • Strength of masonry. • Brick masonry - principles of construction of bonds. Tools and equipments used. (12 hrs.)
Professional Skill 56Hrs; Professional Knowledge 18Hrs	Draw different types of shallow and deep foundation.	Drawing of Foundation:- Drawing of different types of foundation - Shallow :- 25. Spread Footing. (06hrs) 26. Grillage foundation. (06hrs) Deep - 27. Pile foundation. (12hrs) 28. Raft foundation. (12hrs) 29. Well foundation. (12hrs) 30. Special foundation. (8hrs)	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 • Drawing of footing foundation setting out of building on ground excavation Simple machine foundation (18 hrs.)
Professional Skill 28Hrs; Professional Knowledge 06Hrs	Draw different types of shoring, scaffolding, underpinning, form work and timbering.	Drawing of :- 31. Shoring.(7hrs) 32. Scaffolding.(7hrs) 33. Underpinning. (7hrs) 34. Timbering. (7hrs)	Building Construction:- • Types of shoring and scaffolding in details. • Types of Underpinning and Timbering in detail (06 hrs.)
Professional Skill 28Hrs; Professional Knowledge 06Hrs	Drawing of different types of damp proofing in different position.	Drawing details of treatments in building:- 35. Damp proofing. (06hrs) 36. Anti-termites. (06hrs) 37. Fire proofing. (16hrs)	Treatments of building structures:- • DPC Sources and effects of dampness • Method of prevention of dampness in building • Damp proofing materials - properties, function and types. • Anti-termite treatment - objectives, uses and applications.
Professional Skill 56Hrs; Professional Knowledge 12Hrs	Drawing of different types of arches and lintels with chajja.	Draw different forms of :- 38. Arches. (22hrs) 39. Lintels. (12hrs) 40. Lintels with Chajjahs. (22 hrs)	• Arches: - Technical terms-. types, centring • Lintel :-types,wooden, brick, stone, steel & RCC. • Chajjahs - characteristics, Centring& Shuttering (12 hrs.)

Professional Skill 84Hrs; Professional Knowledge 18Hrs	Perform site survey with chain / tape and prepare site plan. Perfom site survey using prismatic compassand prepare site plan. Lo 14 ,15to 18 Perform site survey with plane table and prepare a map.	Surveying:- Chain Survey :- (35 hrs.) 41. Equipment and instrument used to perform surveying.(06hrs) 42. Distance measuring with chainand tape. (08hrs 43. Entering Field book and plotting. (05hrs) 44. Calculating the area of site. (07hrs) 45. Prepare site planwith the helpof Mouza map. (09hrs Compass survey:- (42hrs) 46. Field work of prismatic compass survey. (07hrs 47. Plotting of prismatic compasssurvey. (05hrs 48. Testing and adjusting thecompass. (08hrs 49. Observation of bearings. (08hrs 50. Bearing a line. (05hrs 51. F.B., B.B., R.B., W.C.B. of aLine, Traverse and also checkthe close traversing. (09hrs) Plane Table Survey :- (07hrs) 52. Surveying of a Building sitewith Plane Table. (07hrs)	Surveying:- • Introduction, History and principles of chain survey. • Instrument employed. • Use, care, maintenance and common terms. • Classification, accuracy, types. • Main divisions (plane & geodetic). • Chaining. • Speed in field and office work. • Knowledge of Mouza Map. Compass survey:- • Instrument and its setting up • Bearing and each included angle of close traverse. • Local attraction. • Magnetic declination and its true bearing. • Precaution in using prismatic compass. Plane table survey:- • Instrument used in plane table survey • Care and maintenance of plane table (18 hrs.)
Professional Skill 28Hrs; Professional Knowledge 12Hrs	Drawing of different types of carpentry joints. Draw different types of doors and windows according to Manner of construction, Arrangement of component, and working operation	Making detailed drawing of :- 53. Carpentry joints:- lengthening, bearing, housing, framing, panelling&moulding. (11hrs) 54. Different Types doors including panelled, glazed and flush door. (11hrs) 55. Different types windows and ventilators. (06hrs)	• Carpentry joints :- terms, classification of joints, Uses, types of fixtures , fastenings. • Doors -Parts, Location, standard sizes, types. • Windows-types. • Ventilators-purpose-types. (12 hrs.)
Professional Skill 28Hrs; Professional Knowledge 06Hrs	Prepare the detailed drawing of electrical wiring system.	Electrical Wiring:- Prepare drawing of 56. Wiring in different system.(08hrs) 57. Electrical wiring plan with all fittings showing in drawing.(20 hrs)	Electrical Wiring:- • Safety precaution and elementary first aid. • Artificial respiration and treatment of electrical shock • Elementary electricity. • General ideas of supply system.

			• Wireman's tools kit. Wiring materials. Electrical fittings. • System of wirings. Wiring installation for domestic lightings (06 hrs.)
Professional Skill 28Hrs; Professional Knowledge 06Hrs	Draw types of ground and upper floors.	Drawing details of:- 58. Types of ground & upper floors. (14hrs) 59. Various floor finishing, sequence of construction. (14hrs)	• Floors - Ground floor & upper floor-Types. • Flooring- materials used types. (06 hrs.)
Professional Skill 56Hrs; Professional Knowledge 12Hrs	Draw different types of vertical movement according to shape, location, materials by using stair, lift, ramp and escalator.	Drawing different forms of vertical movements:- 60. As per shape - Drawing of straight, open newel, dog- legged, geometrical and bifurcated stairs & spiral stairs. (18hrs) 61. As per material - brick, stone, wooden, steel & RCC stairs. (20 hrs) 62. Drawing of Lift and Escalator. (18hrs)	• Stairs:- Terms. Requirements, Planning and designing of stair and details of construction. • Basic concept of lift and Escalator (12 hrs.)
Professional Skill56Hrs; Professional Knowledge 18Hrs	Draw different types of roofs, truss according to shape, construction, purpose and span	Drawing details of:- 63. Slopped/Pitched Roof Truss - King Post and Queen Postroof trusses showing detailed connections. (23hrs) 64. Steel roof trusses showing detailed connections. (21hrs) 65. Wooden roof truss, showing detailed connections. (12hrs)	Roofs & Roof coverings: - • purposes, Elements, Types, Fla, pitched. • Truss-king post, queen post, mansard, bel-fast, steel, composite. • Roof & coverings - objectives, types & uses. (18 hrs.)
Professional Skill 56Hrs; Professional Knowledge 12Hrs	Make tropography map by contours with leveling instruments.	Levelling:- (03 hrs.) 66. Handling of levellinginstruments& their settings(04 hrs.) 67. Temporary adjustment of alevel. (03 hrs.) 68. Simple levelling. 69. Differential levelling (Fly levelling). (03 hrs.) 70. Carry out Levelling field book. (03 hrs.) 71. Equate Reduction of levels - Height of collimation and Riseand Fall method - Comparisonof methods. (04 hrs.) 72. Solve problems on reduction of levels. (03 hrs.) 73. Calculate Missing data and how to fill it up-calculations &Arithmaticalcheckin various problems and its solution. (04 hrs.)	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 adjust ment, procedure in setting up. • Level& horizontal surface. Datum Benchmark, Focussing& parallax • Deduction of levels / Reduced Level. • Types of leveling, Application to chain and Levelling Instrument to Building construction.

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		74. Practice leveling with different instruments. (04 hrs.) 75. Check levelling. (04 hrs.) 76. Profile levelling or Longitudinal, plotting the profile. (03 hrs.) 77. Surveying of a building site with chain and Levelling Instrument with a view to computing earth work. (04 hrs.) 78. Contour - Direct and Indirect methods. (03 hrs.) 79. Make Topography map, contours map. (04 hrs.) 80. Solve trigonometric problems. (03 hrs.) 81. Prepare a road project in a certain alignment. (04 hrs.)	• Contouring ;-Definition, Characteristics, Methods. • Direct and Indirect methods • Interpolation of Contour, Contour gradient , Uses of Contour plan and Map. • Knowledge on road project. (12 hrs.)
Professional Skill 56 Hrs; Professional Knowledge 12 Hrs	Perform a site survey with Theodolite and prepare site plan.	Theodolite survey:- 82. Field work of theodolite. (05 hrs.) 83. Horizontal angle. (05 hrs.) 84. Vertical angle. (05 hrs.) 85. Magnetic bearing of a line. (05 hrs.) 86. Levelling with a theodolite. (05 hrs.) 87. Calculation of area from traverse. (04 hrs.) 88. Determination of Heights. (06 hrs.) 89. Calculation of departure, latitude, northing and easting- (5hrs) 90. Setting out work-Building,culvert, centre line of Dams,Bridges and Slope of Earth work, etc. (16hrs)	Theodolite survey:- • Introduction. • Types of theodolite. • Uses, Methods of Plotting. • Transit vernier theodolite. • Terms of transit theodolite. • Fundamental line of theodolite. • Adjustment of theodolite. • Checks, Adjustment of errors. • Open and closed traverse and their application to Engineering Problems. • Vernier scale- types. • Measurement of horizontal angle. • Measurement of vertical angle. • Adjustment of a close traverse. • Problems in transit theodolite- departure, latitude, northing and easting. (12 hrs.)

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Importance of trade training and demonstrate tools & equipments

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.**

Importance of Draughtsman Civil Trade

- As a draughtsman, the construction of any project, it is important that the perfect planning and designing has to be done.
- Prepare the working drawing and estimation for the required project.
- Safety and precaution- use of fire extinguishers.
- Orthographic projection - types of views.
- Building materials.
- Brick and stone masonry.
- Temporary structure.
- Project work.
- Chain, compass, plane table, levelling, theodolite survey and plotting.
- Doors and windows, electrical wiring, flooring, stair case and pitched roof.
- Residential building, flat, pitched roof, public building.
- Computer practice – 3D modeling in CAD.
- R.C.C and steel structure.
- Public health and sanitation.
- Types of roads.
- Bridge and culvert.
- Railway.
- Irrigation structure.
- Estimating and casting.
- Total station
- GPS awareness

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

Identification of tools and equipment

Objectives: At the end of this exercise you shall be able to
- **identify the name of the tools shown in fig**
- **identify the purpose of the each tools and fill in the table.**

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

Fig 1



TROWEL

DCN1101H1

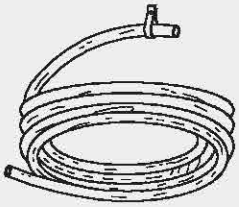
Fig 2



MORTAR PAN

DCN1101H2

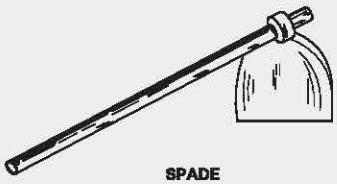
Fig 3



CURING PIPE

DCN1101H3

Fig 4



SPADE

DCN1101H4

Fig 5



COMPACTING ROD

DCN1101H5

Fig 6

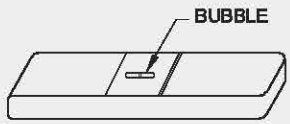


STRAIGHT-EDGE

DCN1101H6

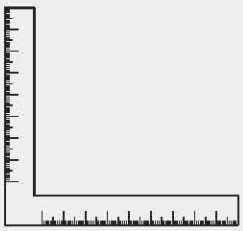
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Fig 7



SPIRIT LEVEL

Fig 8



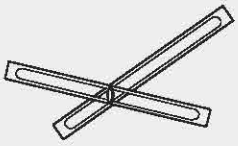
TRY-SQUARE

Fig 9



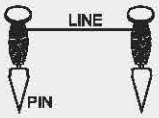
PLUMB RULE

Fig 10



BEVEL

Fig 11



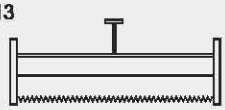
LINE AND PINS

Fig 12



CROSS CUT-SAW

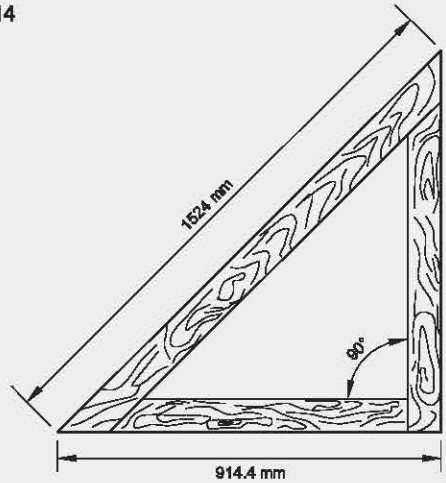
Fig 13



FRAME -SAW

DCN1101H7

Fig14



LARGE SQUARE OR MASON'S SQUARE

DC20N1101HE

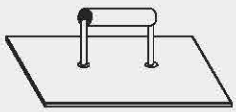
Fig 15



WOODEN FLOAT

DCN1101HF

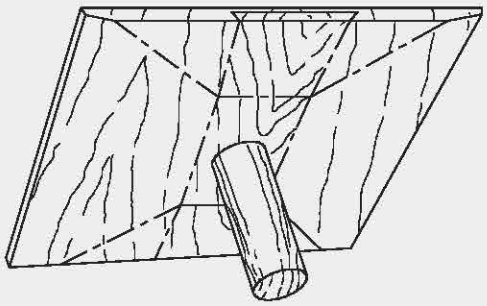
Fig 16



METAL FLOAT

DCN1101HG

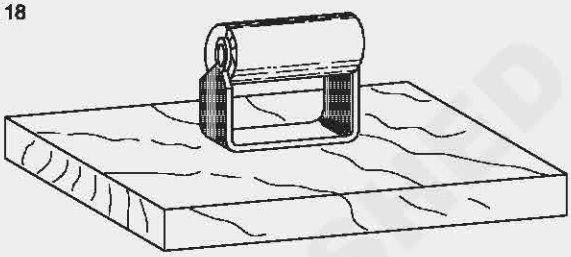
Fig 17



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

DCN1101HH

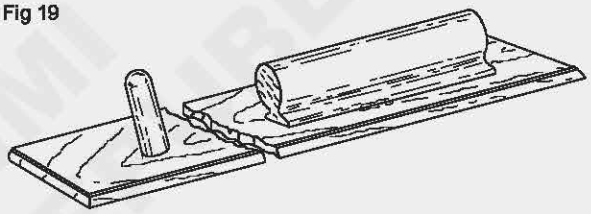
Fig 18



CORK CONSTRUCTION

DCN1101HI

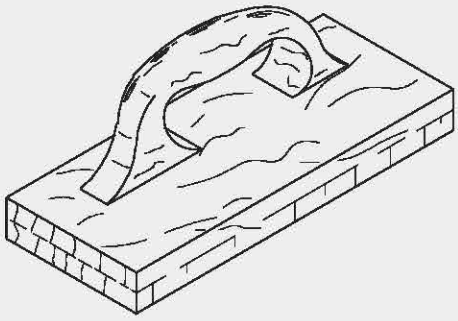
Fig 19



AN ORDINARY WOODEN DARBY USED TO LEVEL LARGE AREAS OF PLASTER

DCN1101HJ

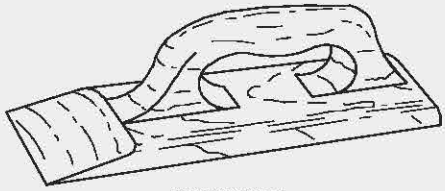
Fig 20



CORK-FACED FLOAT WITH HARD WOOD BACKING

DCN1101HK

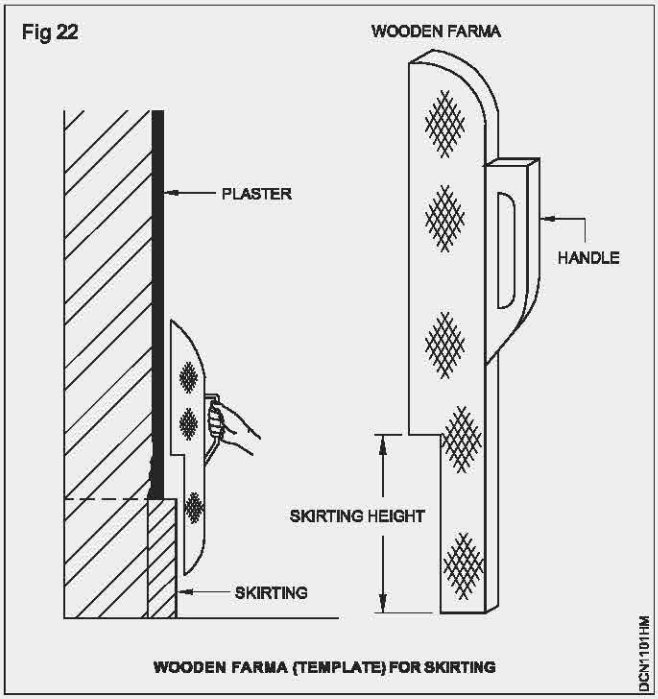
Fig 21



WOOD ANGLE

DCN1101HL

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Trainees should identify the name of the tools and their purposes demonstrated by the instructor.

The trainees are asked fill the name of tools and their purposes in the table 1.

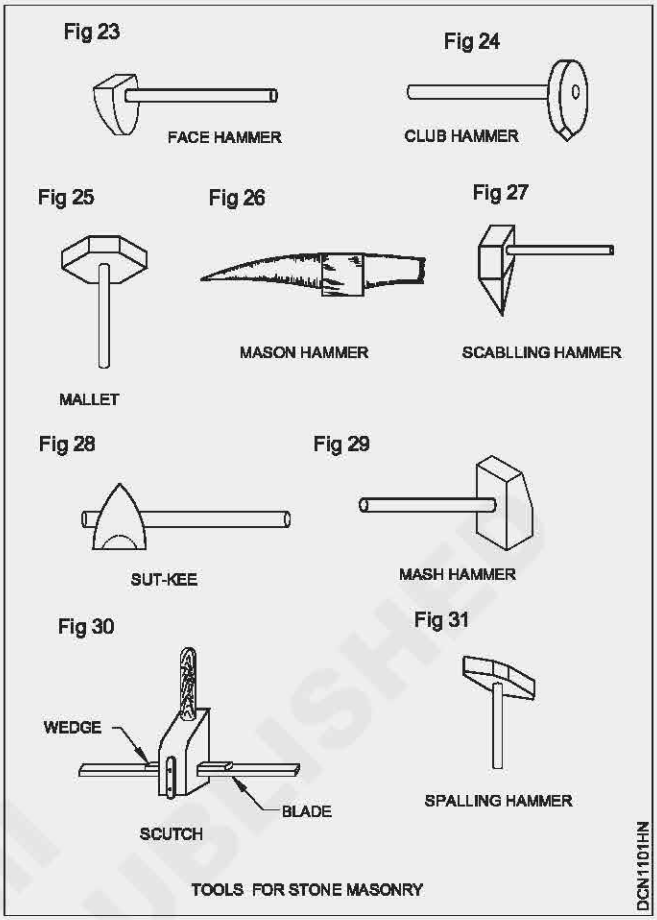


Table 1

Sl. No	Name of the tools	Uses / Purposes
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

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Identification of equipment

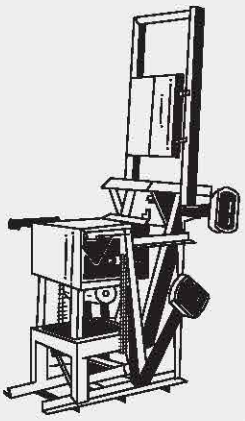
Objectives: At the end of this exercise you shall be able to
- **identify the name of the equipment shown in figure**
- **identify the purpose for the uses shown in figure.**

1 The instructor should demonstrate each equipment and explain their purposes.

The trainee should identify the name of the equipment and their purposes, demonstrated by the instructor.

The trainees are asked to fill the name of the equipment and their purpose in the table 2.

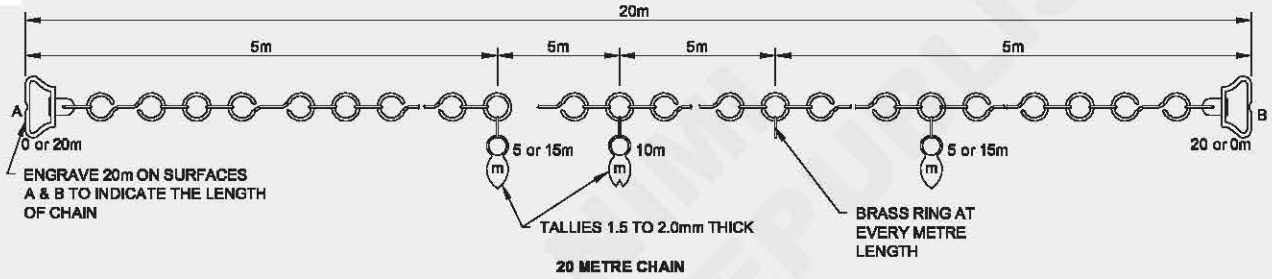
Fig 1



HAND OPERATED BLOCK MACHINE

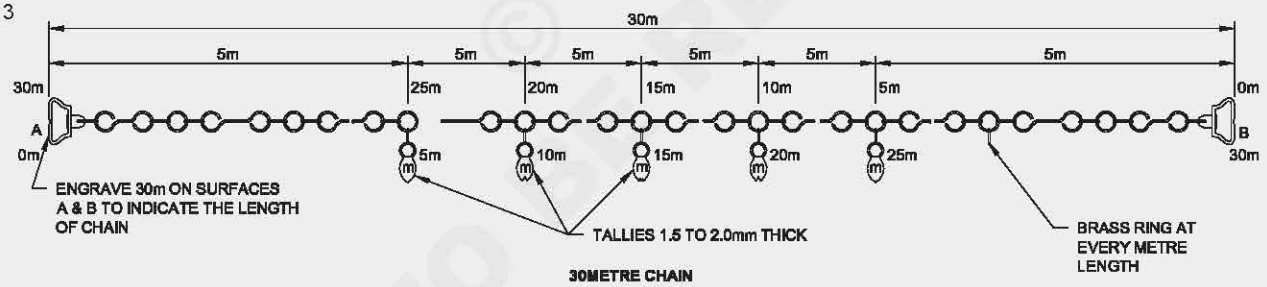
DC20N1101J1

Fig 2



20 METRE CHAIN

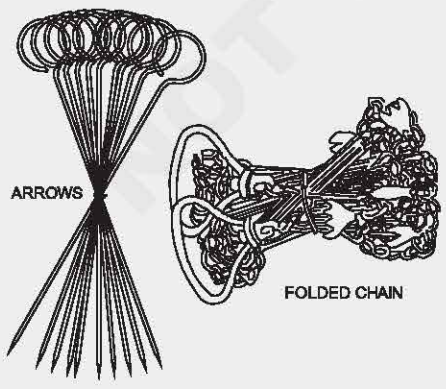
Fig 3



30METRE CHAIN

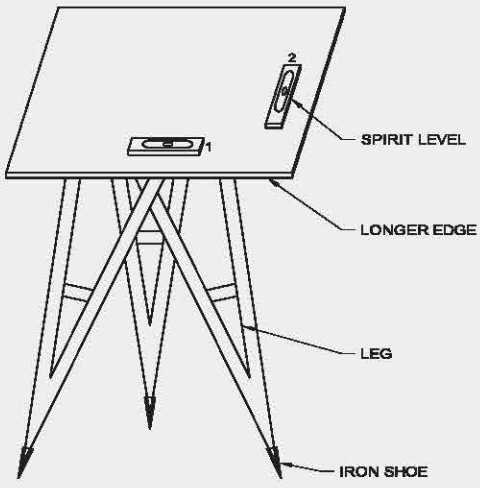
DCN1101J3

Fig 4



DC20N1101J4

Fig 5

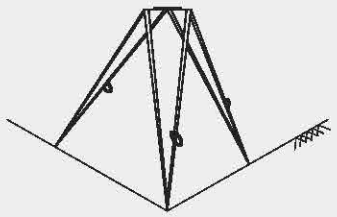


LEVELLING THE PLANE TABLE

DC20N1101J5

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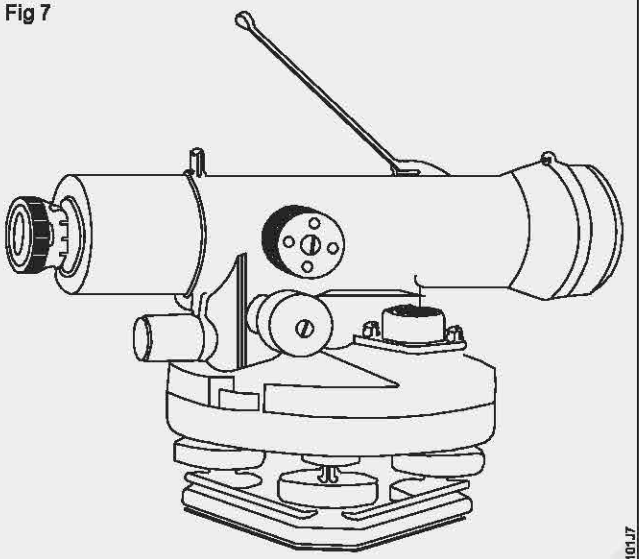
Fig 6



TRIPOD STAND

DC20N1101J6

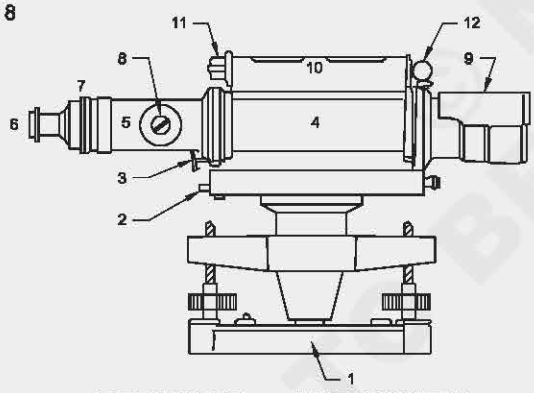
Fig 7



DUMPY LEVEL

DCN1101J7

Fig 8

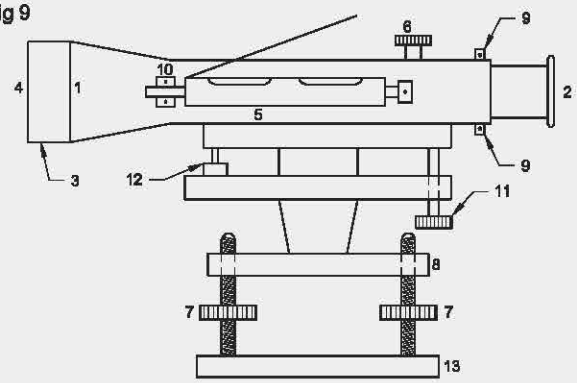


1. LEVELLING HEAD	7. DIAPHRAM SCREWS
2. LIMB NUTS	8. FOCUSSING SCREW
3. STOP-SCREWS	9. RAY-SHADE
4. SOCKET	10. LEVEL TUBE
5. TELESCOPE	11. LEVEL TUBE NUTS
6. EYE-PIECE	12. CROSS-BUBBLE TUBE

COOKE'S REVERSIBLE LEVEL

DCN1101J8

Fig 9

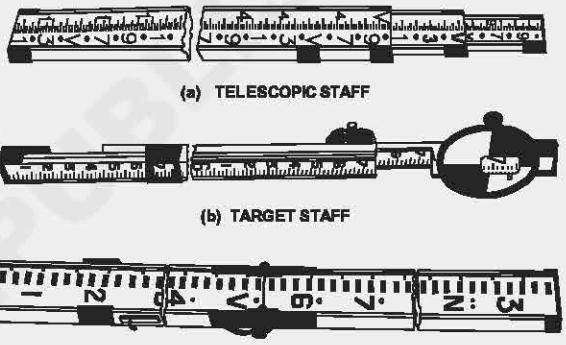


1 TELESCOPE	8 TRIBACH
2 EYE-PIECE	9 DIAPHRAGM ADJUSTING SCREWS
3 RAY SHADE	10 BUBBLE TUBE FIXING SCREWS
4 OBJECTIVE END	11 TILTING SCREWS
5 LEVEL TUBE	12 SPRING LOADED PLUNGER
6 FOCUSING SCREWS	13 TRIVET STAGE
7 FOOT SCREWS	

TILTING LEVEL

DCN1101J9

Fig 10



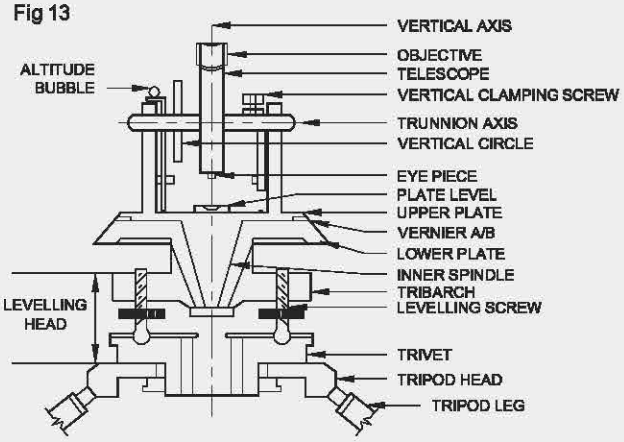
(a) TELESCOPIC STAFF

(b) TARGET STAFF

(c) FOLDING STAFF

DC20N1101JA

Fig 13



SCHEMATIC DIAGRAM OF THEODOLITE

DCN1101JD

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Table 2

Sl. No	Name of the tools	Uses / Purposes
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

— — — — — — — —

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Importance of housekeeping & good shop floor practice

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

Housekeeping

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

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

2 **Cleaning of Machines :** Reduce accidents to keep machines cleaned well.

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 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.
- 55 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 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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Practice on cleanliness and procedure to maintain it

Objectives: At the end of this exercise you shall be able to
- **identify the places/machinery/equipments are to be cleaned**
- **collect the cleaning materials/devices required on cleaning**
- **clean the machines/equipment and devices installed in your section.**

Requirements

Tools / Equipments

- Portable vacuum cleaner/blower - 1 No.

Materials

- Emery sheet 'O' grade - 1 No.
- Dusting cloth - as reqd.
- Dust bin - 3 Nos (labelled)

PROCEDURE

Switch-off all the machinery and equipment before starting the cleaning. Use mask or cover the mouth and nose.

Instructor has to brief the Japanese 5S concept to the trainees before starting the work.

Sort
Set in order
Shine
Standardise
Sustabin

} **5S concept**

1 Identify the areas/equipment machine have to be cleaned.

2 Keep the movable items at one place and group it.

3 Clean the dust carefully without damaging any part/ connection of the machine / equipment, by using clothes.

4 Use wet dusting cloth to shine the areas to be cleaned/ wired.

5 Remove the rust in any of the parts of equipment or devices by using emery sheet.

Do not remove any lubricants applied to the machine for its function while wiping/cleaning.

6 Use vacuum cleaner to suck the dust from the places where brush or cloth cannot be reached.

7 Collect the waste materials found in the lab and put it in the dustbin specified for it, as shown in Fig 1.

Dusting and cleaning can be arranged in groups of trainees under the supervision of instructor.

8 Clean the places where water or oil spill over the floor and dusting particles.

Note down any abnormal things you noticed in particular while doing cleaning and report to the instructor to take action to correct it.

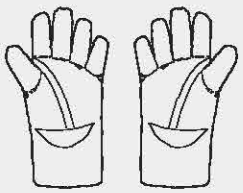
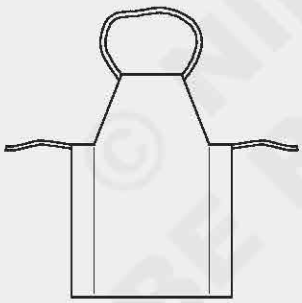
9 Put back all the materials and equipment used for cleaning.

10 Inspect in the presence of instructor and ensure that all the machines are working after cleaning.

11 Discuss with instructor anything you noticed in particular and prepare a report if required to the instructor.

Assign the cleaning work in batchwise daily into the trainees by the instructor in an arranged manner. Dispose the waste as and when required through stores.

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Sl. No.	Sketches	Name of PPE	Type of protection	Uses
1	Fig 1  DC20N1103H1			
2	Fig 2  DC20N1103H2			
3	Fig 3  DCN1103H3			

12 Get it checked by your instructor.

Fig 1



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Disposal of waste materials

Objectives: At the end of this exercise you shall be able to
- **identify the waste material in different category**
- **segregate and arrange the waste materials in it's corresponding bins**
- **dispose non saleable and saleable material separately and maintain record.**

Requirements

Materials

• Shovel	-1 No.	• Trolley with wheels	- 3 Nos.
• Plastic/Metal bins	- 4 Nos.	• Brush and gloves	- 1 Pair

PROCEDURE

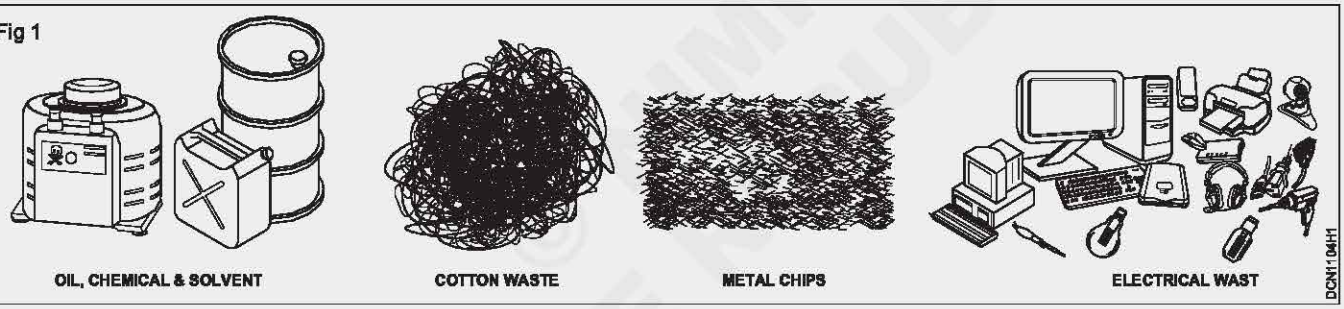
1 Collect all the waste materials in workshop.

2 Identify and segregate the different waste like cotton waste. metal chips, all chemical waste and electrical waste etc. (Fig 1) separately and label them.

3 Segregate saleable, non saleable, organic and inorganic materials also.

4 Record the segregated waste material and fill the Table - 1.

Fig 1



Table

Sl.No.	Name of the waste material	Quantity	Saleable or non Saleable
1			
2			
3			
4			
5			
6			

5 Arrange atleast 3 trollies with wheel for disposal and stick the lable an each trolly as "Cotton Waste", "Metalchips" and "others" (Fig 2)

6 Put the cotton waste in cotton trolly and similarly put the metal chips waste and others in corresponding trollys.

7 Keep another 4 bins to collect saleable scarp. non saleable scrap, organic waste and in-organic waste and lable them. (Fig 3)

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Fig 2

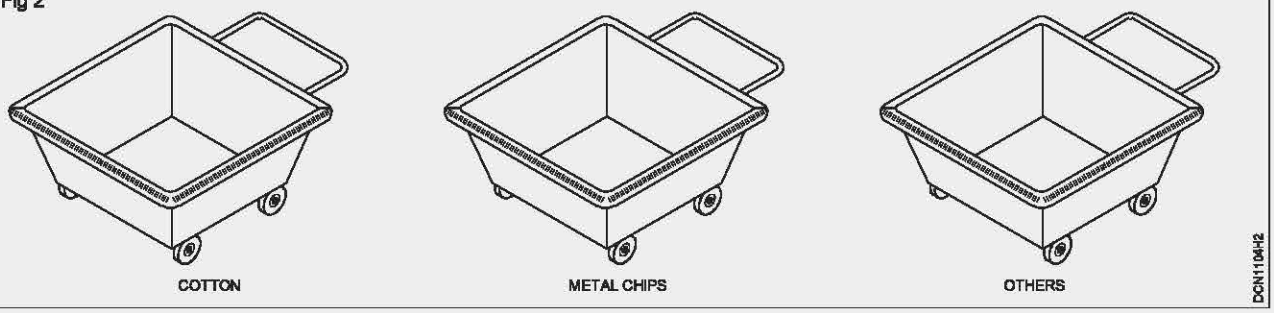


Fig 3



Skill sequence

Separate the cotton waste and dispose it

Objective: This shall help you to

- **separate and dispose the cotton waste.**

1 Collect the chips by hand shavel with help of brush.

2 Clean the floor if oil is spill.

Do not handle the chip by bare hand there may be different metal chips. So separate the chip according to metal.

3 Separate the cotton waste material and store in the bin provided to store the waste cotton material.

4 Store the each category similarly of metal chip in separate bins.

Each bin have respective label.

5 Collect all the saleable material metal and non - metal seperately and keep it's respective bins.

6 Collect all the non - saleable materials like cotton waste, paper waste, wooden pieces etc. and keep it's respective bin as in Fig 3.

7 Check the non - saleable material work (organic) and send it for disposal by burning after getting approval.

8 Check the saleable material and segregate like Aluminium, Copper, Iron, Screws, nuts and other items separately and send to stores for disposal by auction (or) as per recommended procedure with approval.

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Use of personal protective equipment (Occupational Safety)

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

- **read and interpret the different types of Personal Protective Equipment (PPE) from the chart (or) real PPE**
- **identify and name the PPEs for the corresponding type of protection and write their uses.**

Requirements

Tools / Equipments

- Chart showing different types of PPEs - 1 No.
- Real PPEs (available in section) - as reqd.

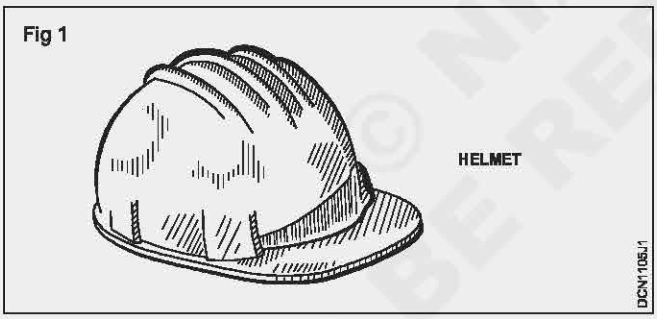
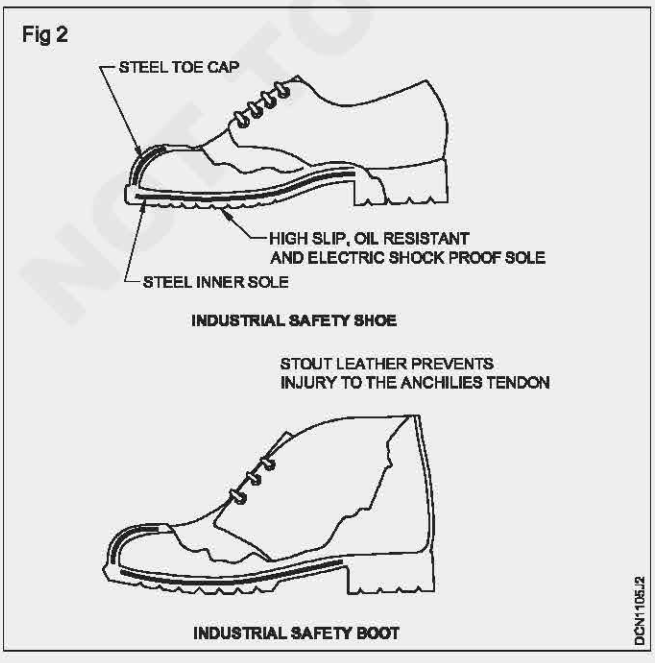
PROCEDURE

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.

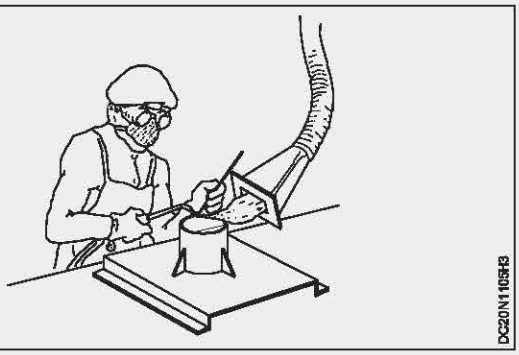
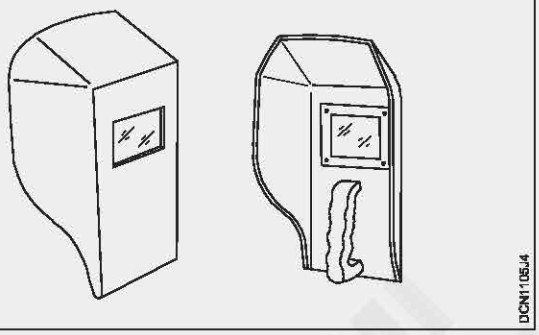
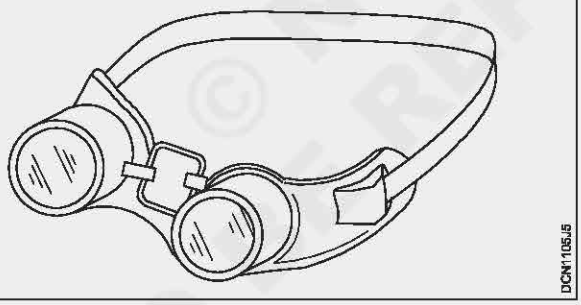
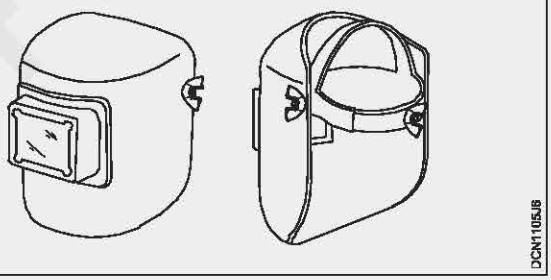
1 Identify the type of PPEs and write their names to the corresponding PPE, by referring from chart (or) read PPEs in Table 1.

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	Fig 1 			
2	Fig 2 			

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Sl. No.	Sketches	Name of PPE	Type of protection	Uses
3	Fig 3  DC20N1105#3			
4	Fig 4  DCN1105J4			
5	Fig 5  DCN1105J5			
6	Fig 6  DCN1105J6			

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Identify safety symbols and hazards

Objectives: At the end of this exercise you shall be able to
- **identify the safety symbols from the chart and their basic category**
- **write their meaning and description and the place of use**
- **identify the road safety sign with traffic signal from the chart**
- **read and interpret the different types of occupational hazards from the chart.**

Requirements

Materials

- Basic safety signs chart -1 No.
- Road safety signs and traffic signal chart - 1 No.
- Occupational hazards chart - 1 No.

PROCEDURE

TASK 1 : **Identify the safety symbols and interpret their meaning and colour with shape**

Instructor may provide various safety signs chart for basic categories and road safety with traffic signals. Then explain their categories meaning and colour. Ask the trainees to identify the sign and record in table 1.

1 Identify the basic category of each sign from the chart.

2 Write the categories name of the each sign meaning description and the place of use of that safety sign in Table 1.

Table 1

No.	Safety signs	Name of the basic category and sign	Place of use
1			
2			
3			
4			
5			

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No.	Safety signs	Name of the basic category and sign	Place of use
6	 WEAR HEAD PROTECTION		
7	 TOXIC HAZARD		
8	 WEAR EYE PROTECTION		
9	 RISK OF FIRE		
10	 PEDESTRIANS PROHIBITED		
11	 WEAR HEARING PROTECTION		
12	 SMOKING AND NAKED FLAMES PROHIBITED		
13	 RISK OF ELECTRIC SHOCK		

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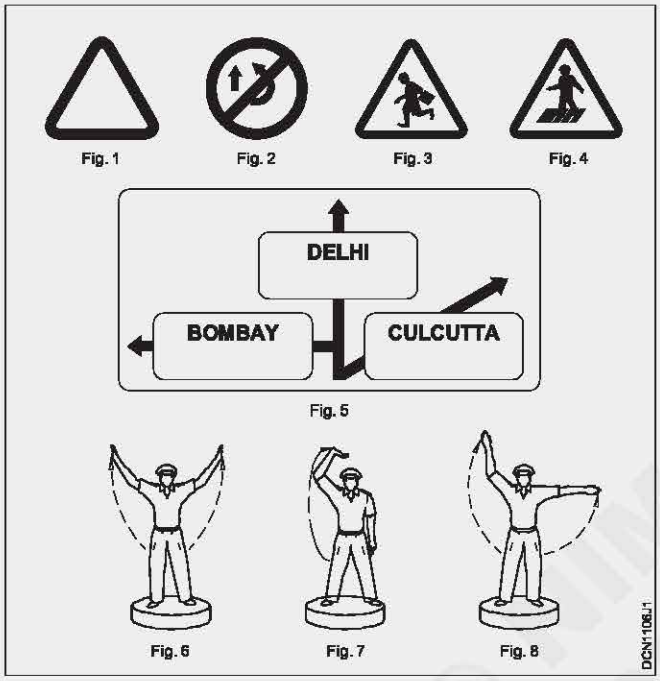
TASK 2 : **Identify the road safety sign and traffic signals**

Instructor will explain all the road safety sign and traffic police signals.

1 Read the sign given and mention their kinds and the meaning in the table 1.

2 Get it checked by the instructor.

Table 2

No.	Safety signs	Name of the basic category and sign	Place of use
			

TASK 3 : **Read and interpret the different types of personal protective devices from the chart**

Instructor may brief the various types of occupational hazards and their causes.

1 Identify the occupational hazard to the corresponding situation with a potential harm given in table 3.

2 Fill up and get it checked by your instructor.

Table 3

Sl.No.	Source or potential harm	Type of occupational hazards
1	Noise	
2	Explosive	
3	Virus	
4	Sickness	
5	Smoking	
6	Non control device	
7	No earthing	
8	Poor housekeeping	

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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.**

Requirements

Materials

- Heavy insulated screw driver 200 mm -1 No.
- Electrical safety chart (or) display - 1 No.
- Gloves - 1 No.
- Rubber mat - 1 No.
- Wooden stool - 1 No.
- Ladder - 1 No.
- Safety belt - 1 No.

PROCEDURE

TASK 1 : **Practice and follow the preventive safety rules to avoid electrical accident**

1 Do not work on live circuits. If unavailable use rubber gloves or rubber mats, etc.

2 Do not touch bare conductors.

3 Stand on a wooden stool or an insulated ladder while repairing live electrical circuits/appliances or replacing fused bulbs.

4 Stand on rubber mats while working, operating switch panels, control gears, etc.

5 Use safety belts always, while working on poles or high rise points.

6 Use wooden or PVC insulated handle screw drivers when working on electrical circuits.

7 Replace (or) remove fuses only after switching off the circuit switches.

8 Open the main switch and make the circuit dead.

9 Do not stretch your hands on any moving part of rotating machine and around moving shafts.

10 Use always earth connection for all electrical appliances along with 3-pin sockets and plugs.

11 Do not connect earthing to the water pipe lines.

12 Do not use water on electrical equipment.

13 Discharge static voltage in HV lines/equipment and capacitors before working on them.

14 Keep the workshop floor clean and tools in good condition.

TASK 2 : **Perform the immediate steps to be taken to solve the shocked victim**

1 Proceed with treatment at once without panic emotion.

2 Break the contact either by switching off the power or removing the plug or wrenching the cable free.

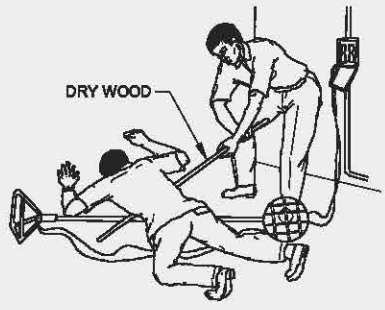
3 Remove the victim from contact with the live conductor by using dry non-conducting materials such as wooden bar. (Fig 1 & 2)

Avoid direct contact with the victim. Wrap your hands in dry material if rubber gloves are not available. If you remain un-insulated, do not touch the victim with your bare hands.

4 Keep the patient warm and at mental rest.

Ensure of good air circulation and comfort. Call for help to shift the patient to safer place. If the victim is aloft action to be taken to prevent him from falling.

Fig 1



5 Loosen the clothing about the neck chest and waist and place in recovery position. If the victim is unconscious.

6 Keep the victim warm and comfortable. (Fig 3)

7 Send the person to call doctor, in case of electric burns.

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Fig 2

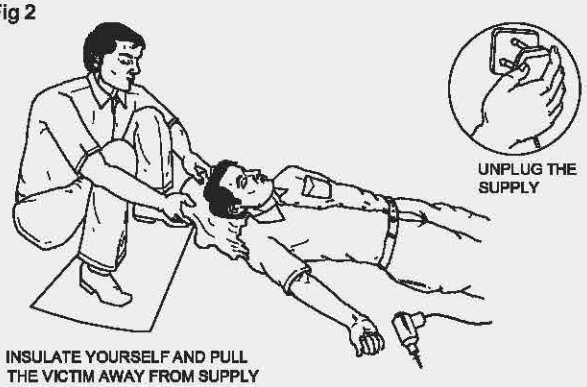
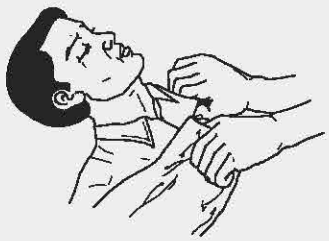


Fig 3



If the victim gets electrical burns due to shock, burns are very painful and dangerous. If a large area of the body is burnt give no treatment. But do the first aid as given below.

8 Cover the burnt area with running pure water.

9 Clean the burnt area by using clean cloth/cotton.

10 Send a person to call the doctor immediately.

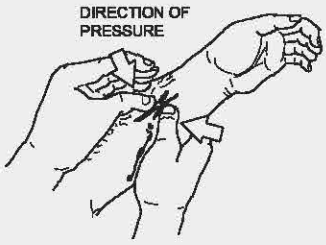
In case of severe bleeding

11 Lay the patient lie down and rest.

12 Raise the injured part above the level of the body. (If possible)

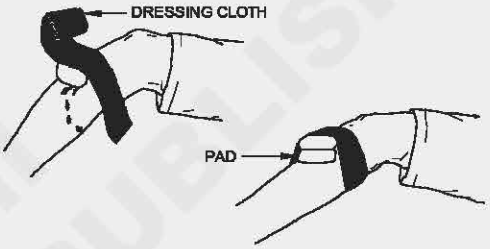
13 Apply pressure on the wound as long as necessary to stop the bleeding. (Fig 4)

Fig 4



14 Apply a clean pad and bandage firmly, if it is large wound. (Fig 5)

Fig 5



If bleeding is severe apply more than one dressing.

14 Proceed to perform the right methods of artificial respiration.

Practice safe methods of fire fighting in case of electrical fire

Objectives: At the end of this exercise you shall be able to
- **demonstrate the ability of fire-fighting for electrical fire**
  - **as a member of the fire-fighting team**
  - **as a leader of the group.**

Requirements

Equipment/Machines

- Fire extinguishers CO_2 - 1 No.

PROCEDURE

General procedure to be adopted in the event of electrical fire

1 Raise an alarm. Follow the method written below for giving an alarm signals when fire breakes out.

- by raising your voice and shouting Fire! Fire! to call the attention of others
- running towards fire alarm/bell to actuate it
- other means
- switch off the control main switch (if possible)

2 On receipt of the alarm signal:

- stop working
- turn off all machinery and power
- switch off fans/air circulators/exhaust fans. (Better switch off the sub-main)

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3 If you are not involved in fighting the fire:

- leave calmly using the emergency exit.
- evacuate the premises
- assemble at a safe place along with the others
- check, if anyone has gone to inform about the fire break to the concerned authority
- close the doors and windows, but do not lock or bolt

As a member of the fire-fighting team

4 If you are involved in fire fighting:

- take instructions for an organised way of fighting the fire.

If taking instructions:

- follow the instructions, and obey, if you can do so safely; do not risk getting trapped.
- do not initiate your own idea.

As a leader of the group

If giving instructions:

- select co_2 fire extinguisher
- send for sufficient assistance and inform the fire brigade
- locate locally available suitable means to put out the fire
- judge the magnitude of the fire, ensure emergency exit paths are clear of obstructions and then attempt to evacuate (Remove explosive materials, substances that can serve as a ready fuel for fire within the vicinity of the fire break.)
- fight out the fire with assistance to put it out, by naming the person responsible for each activity.

5 Report the fire accident and the measures taken to put out the fire, to the authorities concerned.

Reporting all fires however small helps in the investigation of the cause of the fire. It helps to prevent the same kind of accident occuring again.

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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**
- **extinguish the fire.**

Requirements

Equipment/Machines

- Fire extinguishers CO_2 - 1 No.
- Scissor 100mm - 1 No.
- Cell phone - 1 No.

PROCEDURE

1 Alert people surrounding by shouting fire, fire, fire when observe fire (Fig 1a & b).

2 Inform fire service or arrange to inform immediately (Fig 1c).

3 Open emergency exist and ask them to go away (Fig 1d).

4 Put "Off" electrical power supply.

Do not allow people to go nearer to the fire.

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

6 Assume the fire is D type (Electrical fire).

Fig 1

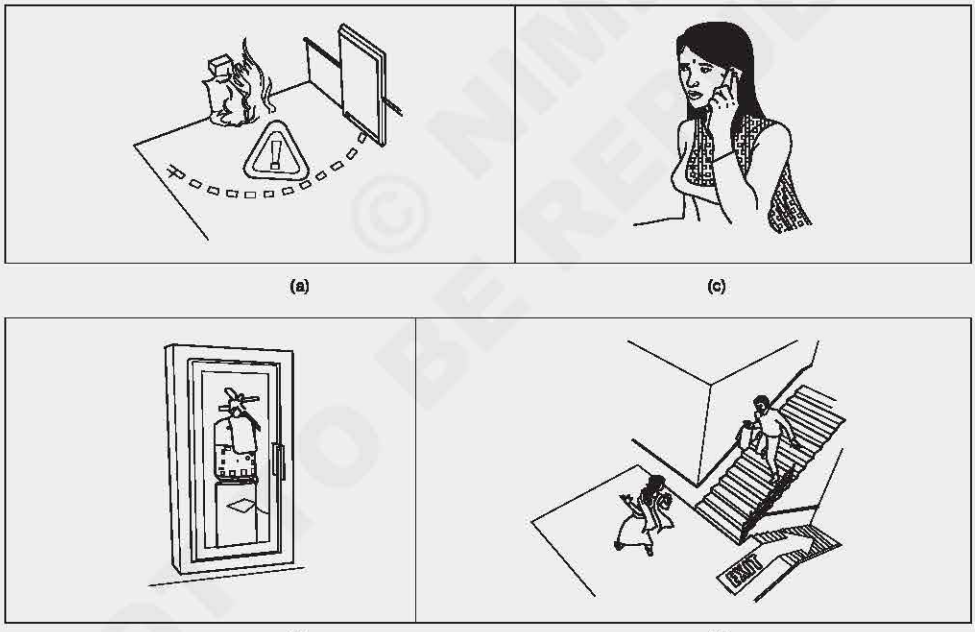
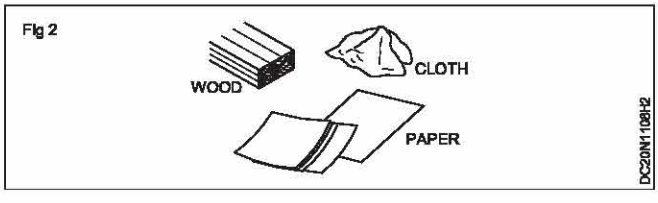
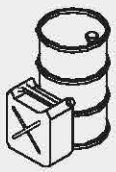
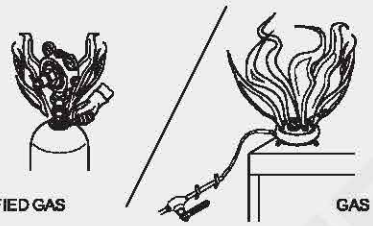


Table 1

Class 'A': Wood, paper, cloth, solid material	Fig 2 

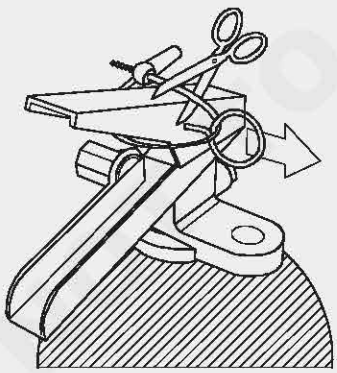
Class 'B': Oil based fire (grease, gasoline,oil) & liquefiable solids	Fig 3 CLASS 'B' FIRE  FLAMMABLE LIQUIDS AND LIQUIFIABLE SOLIDS DC20N1108H3
Class 'C' Gas and liquefied gases	Fig 4 CLASS 'C' FIRE  LIQUIFIED GAS GAS DC20N1108H4
Class 'D' Metals and electrical equipment	Fig 5  METALS DC20N1108H5

6 Select CO_2 (carbon dioxide) fire extinguisher.

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

8 Break the seal. (Fig 6)

Fig 6



DCN1108H6

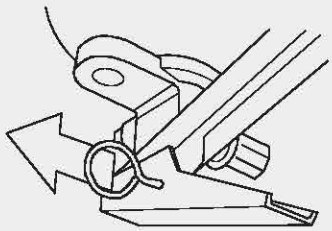
9 Pull the safety pin from the handle (Fig 7) (Pin located at the top of the fire extinguisher) (Fig 7)

10 Aim the extinguisher nozzle or hose at the base of the fire (this will remove the source of fuel fire) (Fig 8)

Keep your self low

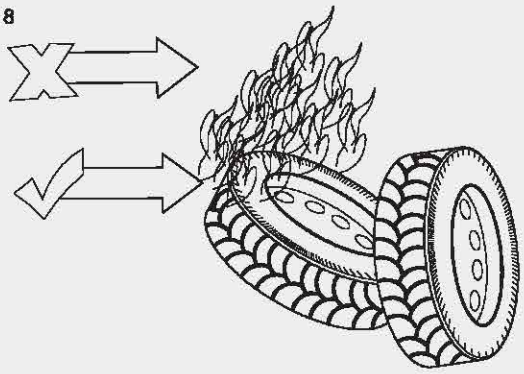
11 Squeeze the handle lever slowly to discharge the agent (Fig 8)

Fig 7



DCN1108H7

Fig 8



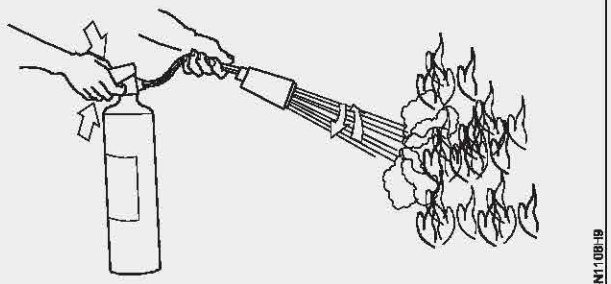
DCN1108H8

12 Sweep side to side approximately 15 cm over the fuel fire until the fire is put off. (Fig 9)

Fire extinguishers are manufactured for use from the distance.

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Fig 9



DCN1108-I9

Caution

- While putting off fire, the fire may flare up.
- Do not be panic so long as it put off promptly
- If the fire doesn't respond well after you have used up the fire extinguisher move away your self away from the fire point.
- Do not attempt to put out a fire where it is emitting toxic smoke, leave it to the professionals.
- Remember that your life is more important than property. So don't place yourself or others at risk.

In order to remember the simple operation of fire extinguisher

Remember

P.A.S.S. This will help to use fire extinguisher

P for pull

A for aim

S for squeeze

S for sweep

Practice elementary first aid

Objective : At the end of this exercise you shall be able to
- **prepare the victim for elementary first aid.**

Requirements

Equipment/Materials

- No. of Persons (Instructor can divide the trainees in suitable No. of groups.) - 20 Nos.

PROCEDURE

Assumption - For easy manageability, Instructor may arrange the trainees in group and ask each group to perform one method of resuscitation.

TASK 1 : **Prepare the victim before giving first aid treatment**

1 Loosen the tight clothing which may interfere with the victim's breathing. (Fig 1)

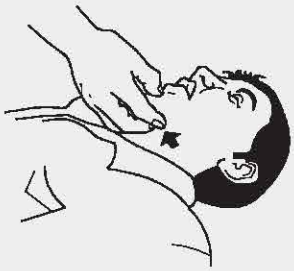
Fig 1



DCN1108J1

2 Remove any foreign materials or false teeth from his mouth and keep the victim's mouth open. (Fig 2)

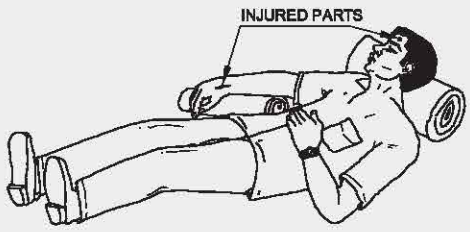
Fig 2



DCN1108J2

3 Bring the victim safely to the level ground, taking necessary safety measures. (Fig 3)

Fig 3



DCN1108J3

Do not waste too much time in loosening the clothes or trying to open the tightly closed mouth.

4 Avoid violent operations to prevent injury to the internal parts of the victim.

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TASK 2 : **Prepare the victim to receive artificial respiration**

1 If breathing has stopped, apply immediate artificial

2 Send word for professional assistance. (If no other person is available, you stay with the victim and render help as best as you can.)

3 Look for visible injury in the body and decide on the suitable method of artificial respiration.

4 Have you observed ? (In this case you are told by the instructor.)

5 In the case of injury/burns to chest and/or belly follow the mouth to mouth method.

6 In case the mouth is closed tightly, use Schafer's or Holgen–Nelson method.

7 In the case of burn and injury in the back, follow Nelson's method.

8 Arrange the victim in the correct position for giving artificial respiration.

All action should be taken immediately.

Delay even by a few seconds may be dangerous.

Exercise extreme care to prevent injury to internal organs.

9 Place the mock victim in the recovery position.

10 Cover the victim with coat, sacks or improvise your own method. It helps to keep the victim's body warm.

11 Proceed to perform the suitables artificial respiration method.

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Awareness of the job sheet made by the Ex-trainees

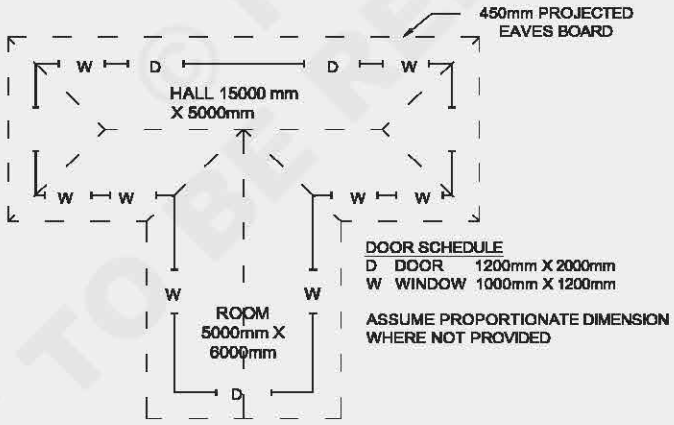
Objectives: At the end of this exercise you shall be able to

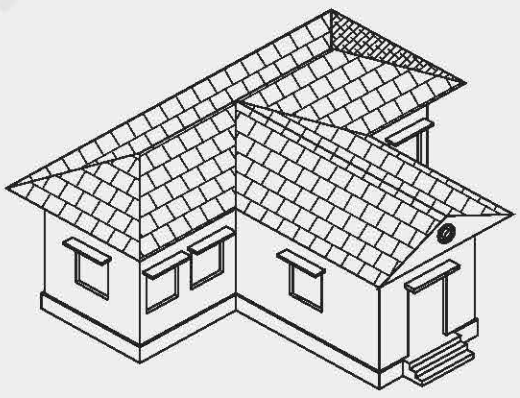
- **identify the features of a pitched roof & building**
- **identify the details and construction features of a mangalore tiled residence**
- **identify details of single room building (Flat)**
- **study the line diagram for a residential building and its plan and section**
- **study a R.C.C sloped building.**

The instructor should explain the following job sheets (Figs 1 & 2) made by the extrainees to create the awareness among the trainees about the building drawing / job sheet which they are all going to execute in feature 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 too. 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 exess 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



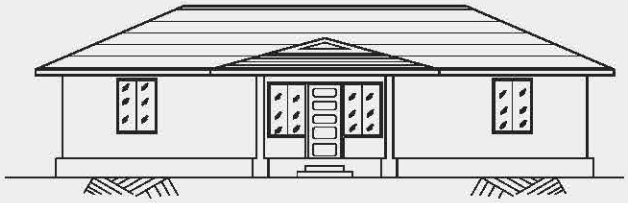


ISOMETRIC & ORTHOGRAPHIC PROJECTION

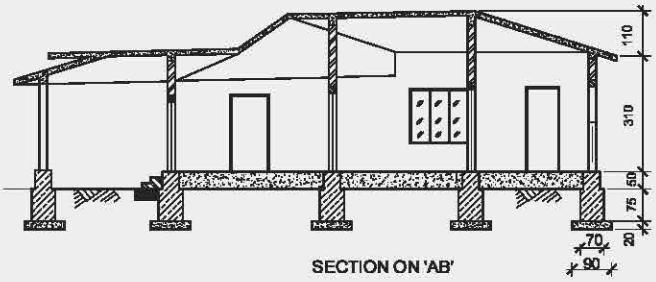
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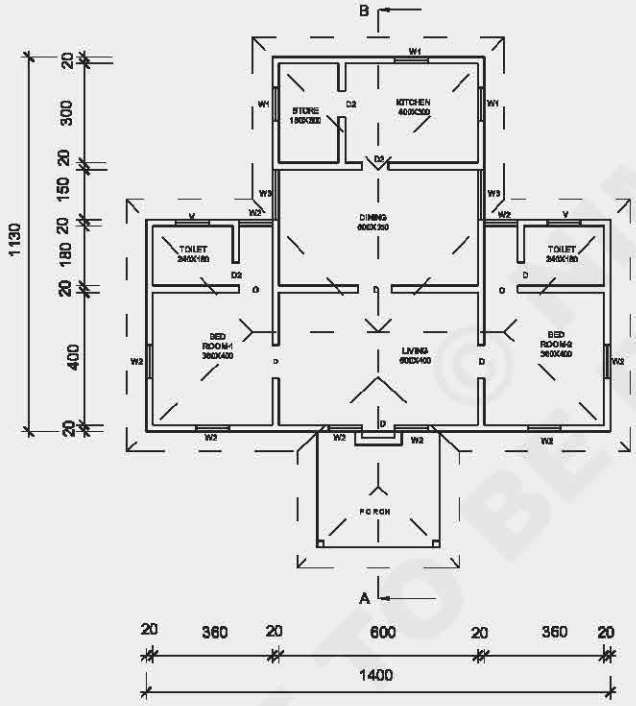
Fig 2



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

A R.C.C SLOPED ROOF

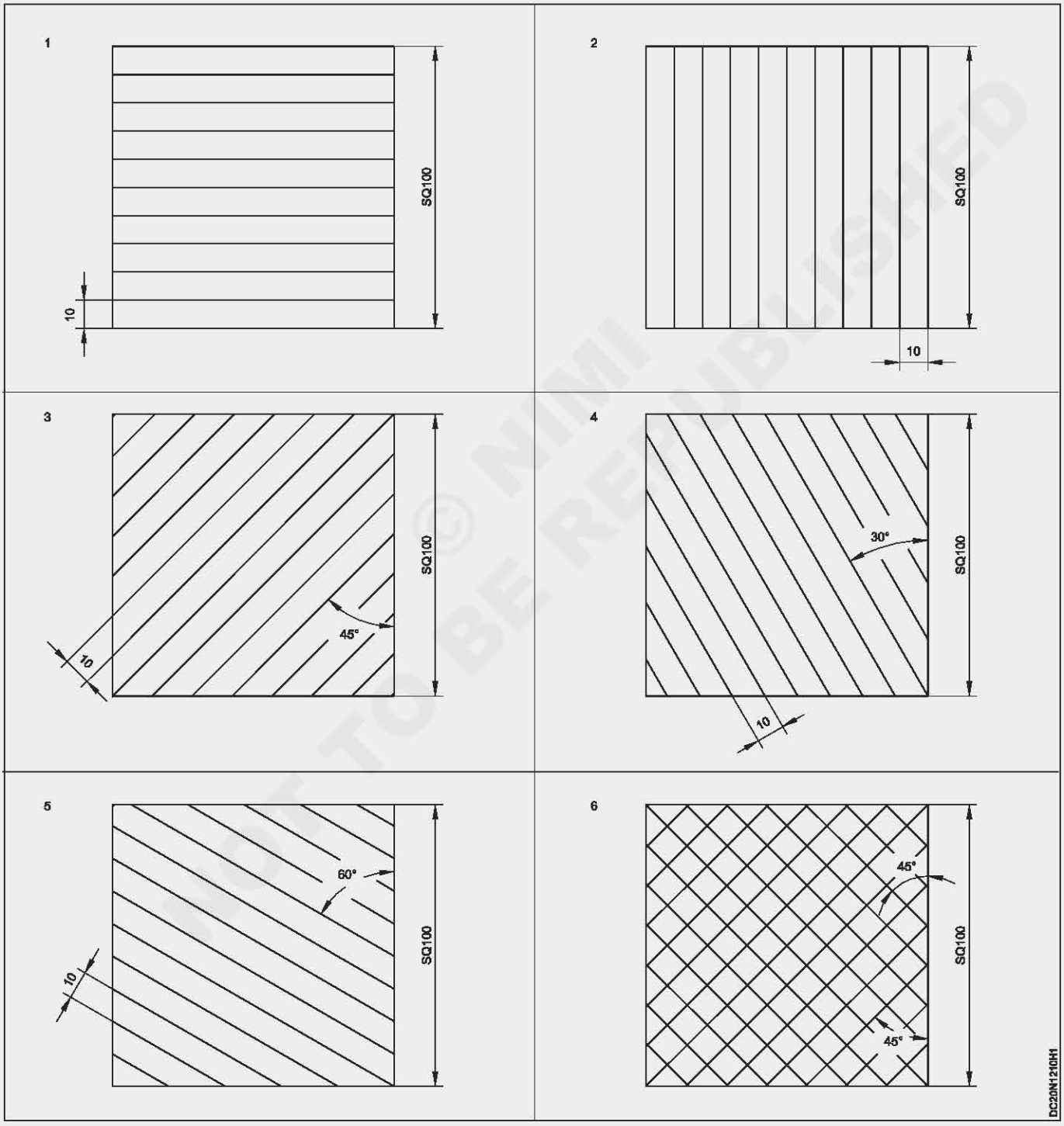
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Use of drawing instrument and equipment with care (line, angle and patterns)

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.**

Exercise 1 to 14: Draw the following patterns and components using straight lines.



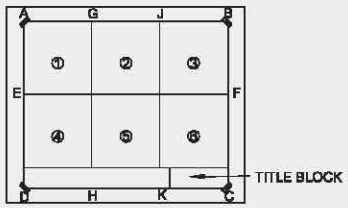
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PROCEDURE

Exercise 1 : Horizontal line

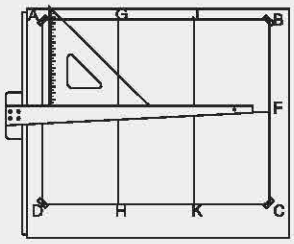
- Layout lines as shown in Fig 1 on an A2 drawing sheet.

Fig 1



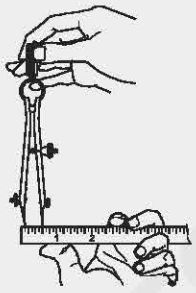
- Butt the 'T' square approximately 5 mm above the line EF.
- Draw a horizontal line 100 mm long left to right. (15 mm from AE)
- Draw a vertical line 100 mm long from the left end of the drawing paper as shown in Fig 2.

Fig 2



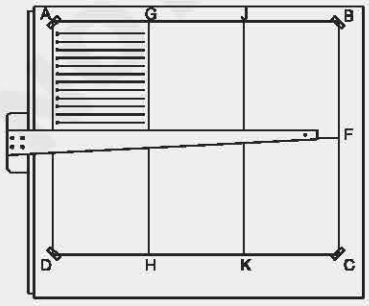
- Mark of points on the vertical line at 10 mm intervals using divider. (Fig 3)

Fig 3



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

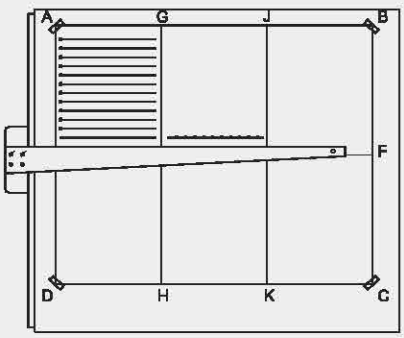
Fig 4



Exercise 2

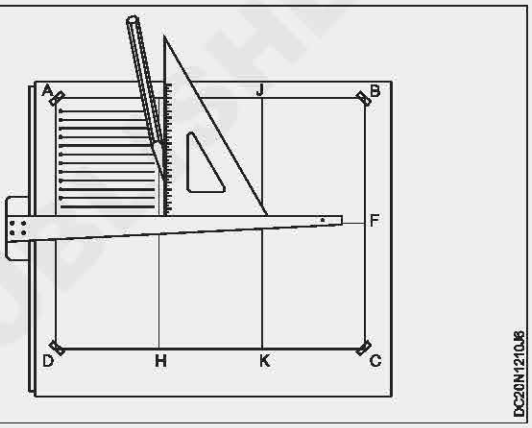
- Draw the thin horizontal line and mark 10 mm spaces as in (Fig 5).

Fig 5



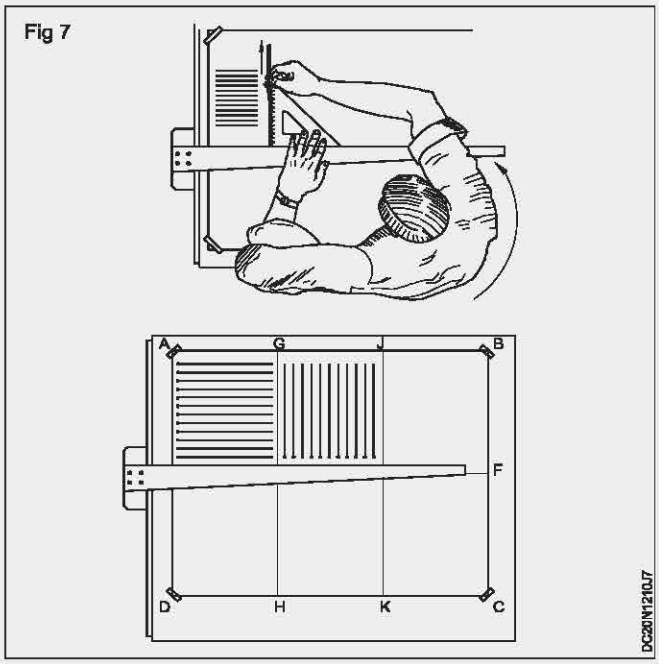
- Place the 30°/60° setsquare on the 'T' square in such a way that its vertical edge is towards the left side of the board, approximately 15 mm from the line GH. (Fig 6)

Fig 6



- Move your left hand onto the 'T' square blade and hold the setsquare firmly in position.
- Hold the pencil approximately at 60° with the paper. (Fig 6)
- Draw a line upwards approximately to a height of 100 mm twisting your body as shown in Fig 7.

Fig 7



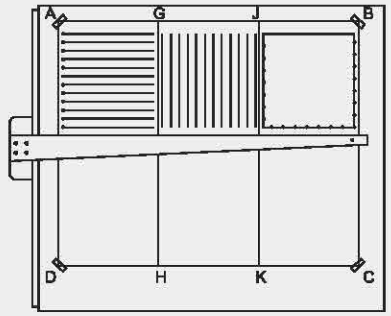
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- Continue to draw the remaining vertical lines.

Exercise 3 to 6 : Inclined lines

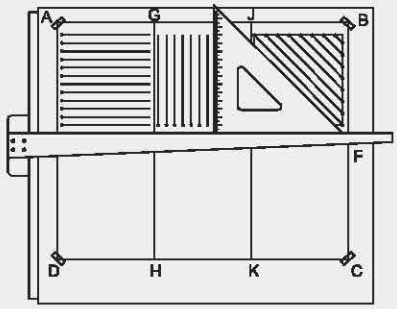
- For drawing 45° lines.
- Place the working edge of the 'T' square 15 mm above the line EF and draw horizontal lines in block (3) as shown.
- Draw vertical lines parallel to JK as shown in the block.
- Using divider, mark points from top corner at 10 mm intervals on horizontal and vertical line. (Fig 8)

Fig 8



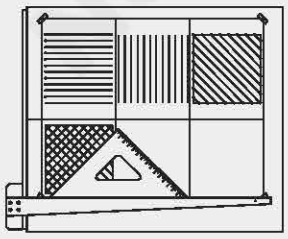
- Butt, slide and take the working edge of 'T' square to line EF.
- Place the 45° setsquare and draw the 45° inclined lines from the corner, top to downwards. (Fig 9)

Fig 9



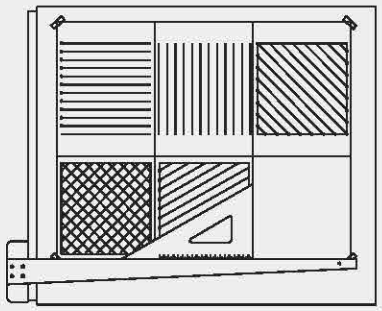
- Hold the blade of the 'T' square and setsquare intact while drawing lines.
- Following the same procedure complete block 4, 5 & 6.
- Draw 45° inclined line in the opposite direction in block 4. (Fig 10)

Fig 10



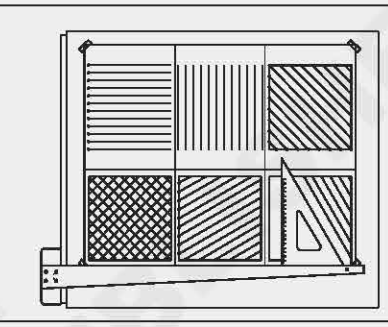
- 30° or/and 60° inclined lines can be drawn with the help of 30° /60° setsquare and 'T' square.
- Draw 30° inclined lines in block 5. (Fig 11)

Fig 11



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

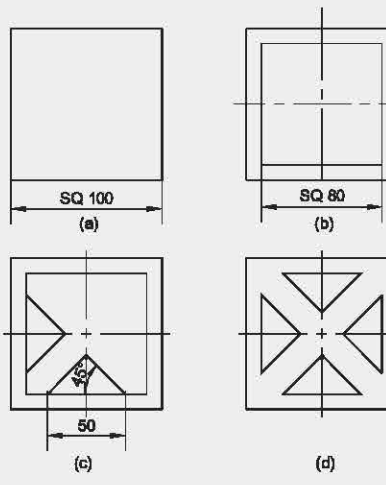
Fig 12



Exercise 7 : Triangles in a square

- Draw a square of side 100 mm long. (Fig 13a)
- Draw another square of side 80 mm as shown in Fig 13b.
- Draw four triangles using 45° setsquare and 'T' square. (Fig 13c & 13d)

Fig 13



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Method of fixing drawing sheet & folding of drawing sheet

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

- **mark the standard folding marks on the designated drawing sheet**
- **fold the drawing sheet sequential as per marking for filing it**
- **fold the different size of drawing sheets**
- **fix drawing sheet.**

PROCEDURE

- Set the drawing paper ON the board.
- Top edge of the drawing paper and edge of drawing should be parallel.
- Check the parallelism of the paper with the T -square.
- If it found correct, fix the paper by tape.
- If not adjust the paper with the edge of the T-square (Fig 1)
- Study the sequence of marking of folds on the designated drawing sheet.
- Start the folding in the sequence means fold vertically first.
- Fold horizontally in such a way so that Title block to be on the top most folds for easy reference.
- Folded drawing sheets filed neatly for submission/ reference in the file.

Fold A0 - Sheet (841X1189)

- Observe carefully Folding marks on the drawing sheet which is started from left to right and bottom to top.
- Start folding sequentially from left side as shown in (Fig 2)
- 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.

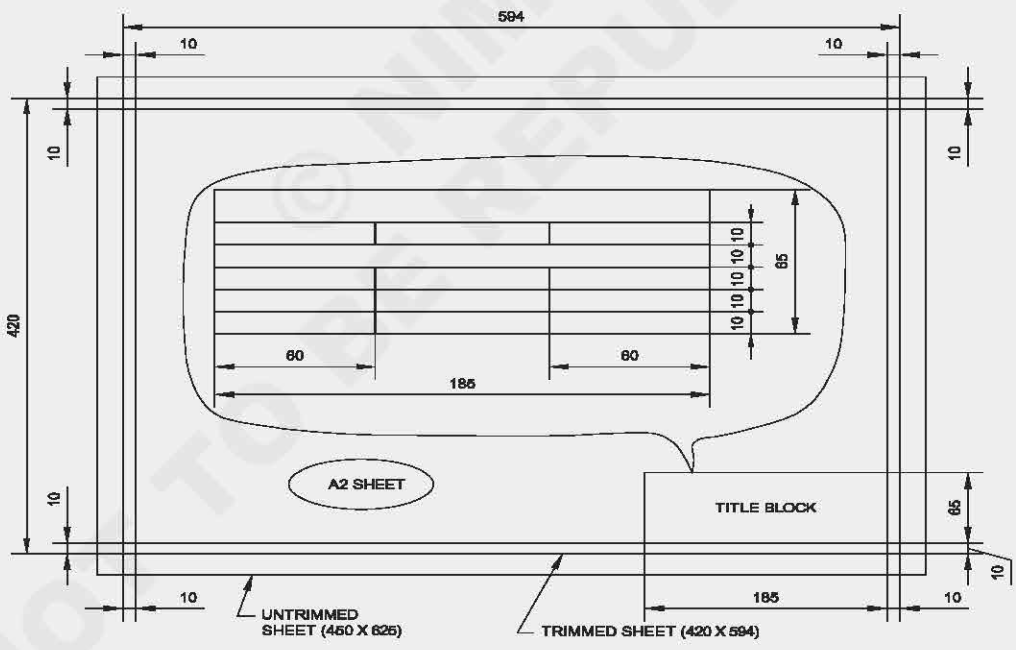
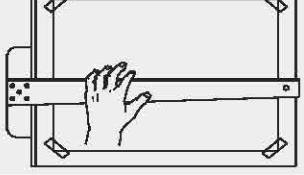


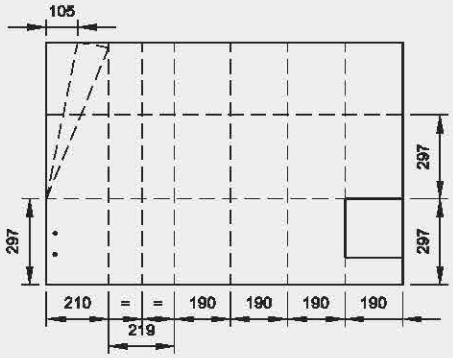
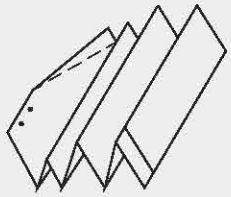
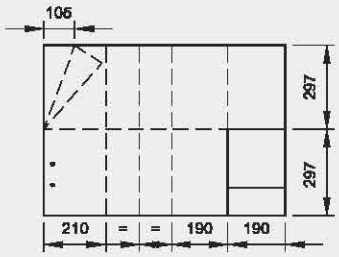
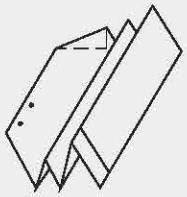
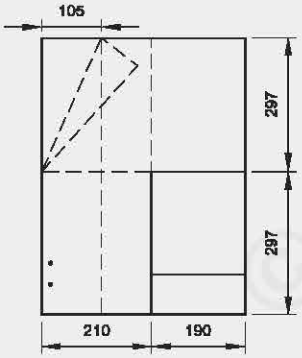
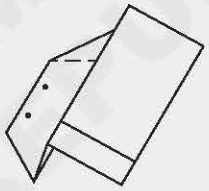
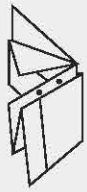
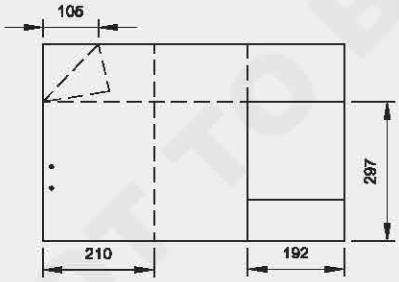
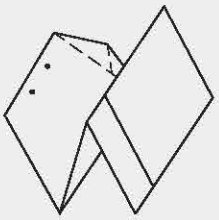
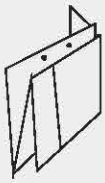
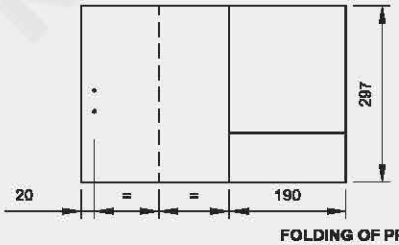
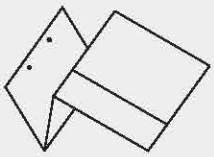
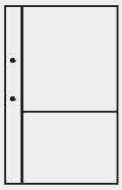
Fig 1



SCALE :	LAYOUT OF DRAWING SHEET	EX NO. 1
PROJECTION		TIME : 6hrs
		CODE : DC20N1211H1

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Fig 2

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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DC20N1211H2

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.

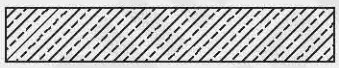
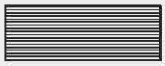
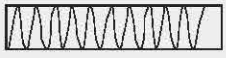
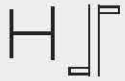
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Symbols & conventional representation for materials in sections as per IS 962-1989

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

PROCEDURE

TASK 1: **Draw the symbols for various materials as shown in figure**

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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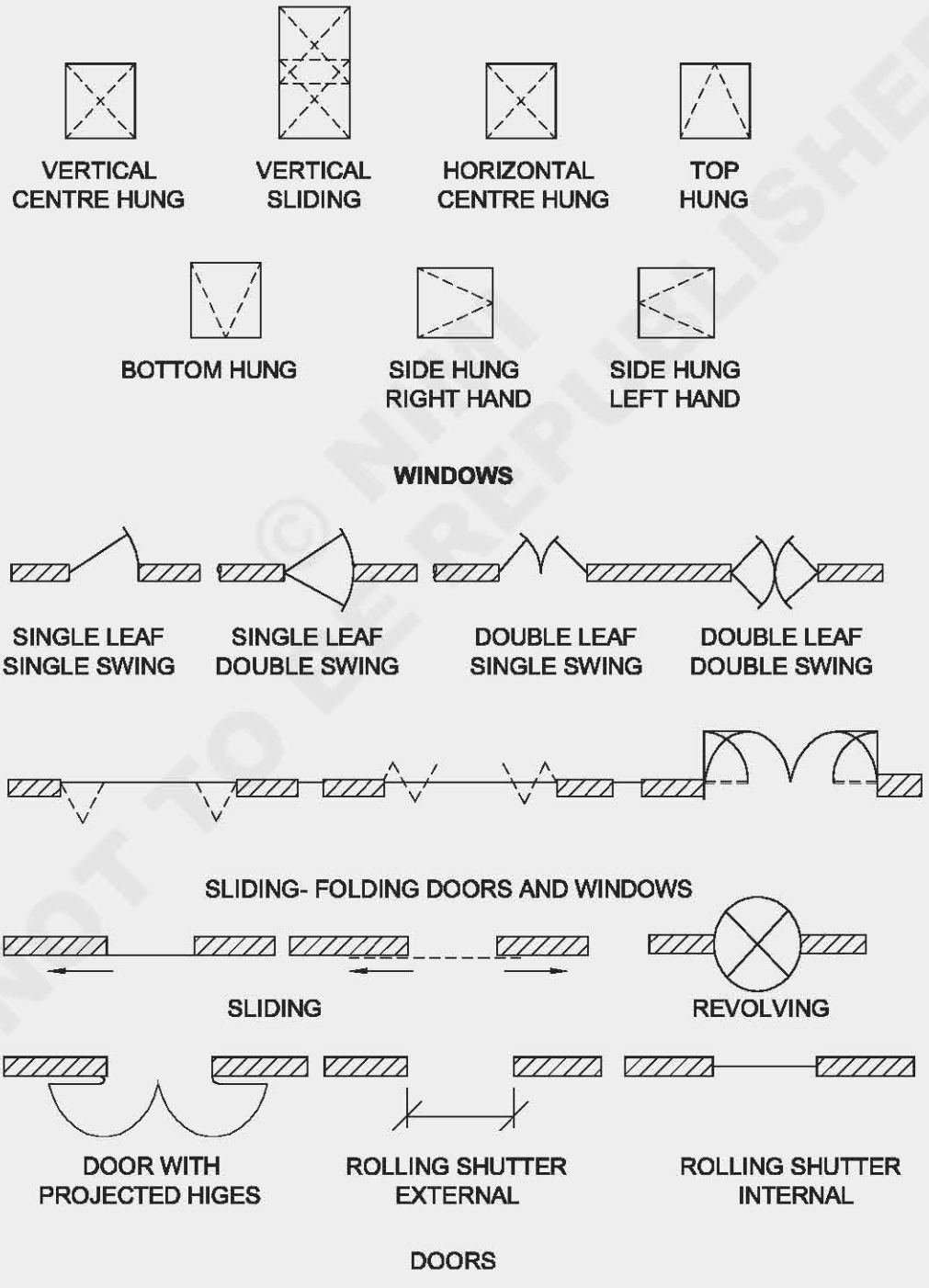
Symbols for Doors & Windows

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 & windows (Fig 1)**

- Layout on drawing area for showing signs and symbols of doors and windows.
- Illustrate signs and symbols of different types of doors and windows.
- Name the illustration drawn.

Fig 1



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DCN1214E2

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**

- Layout on drawing area for showing signs and symbols of sanitary installations and fitment.
- Illustrate signs and symbols of different types of sani tary installations and fitment.
- 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

DCN1214E3

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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 surveying**
- **use appropriate signs and symbols for surveying work.**

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

- Layout on drawing area for showing signs and symbols for surveying.
- Illustrate signs and symbols used for surveying.
- 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		

DCN1214E4

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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**

- Draw the electrical symbols shown.
- Illustrate signs and symbols used in electrical
- 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	

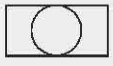
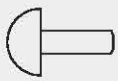
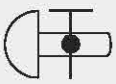
THIS GENERAL SYMBOL IS APPLICABLETO ANY SYSTEM BY THE ADDITION OFAN IDENTIFYING SYMBOL (APPROPRIATE TO A PARTICULAR SYSTEM) IN THE UPPER HALF.FOR EXAMPLE,BELL SYSTEM RELAY.

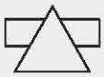
WHERE ITEMS OF OPERATIONS ARE COMBINED, THE SYMBOLS MAY BE COMBINED, FOR EXAMPLE,INDICATOR AND BELL.

NAME	SYMBOL	NAME	SYMBOL
MAIN FUSE- BOARD WITHOUT SWITCHES,LIGHTING		COUNTER WEIGHT PENDANT	CW
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	WT
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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DCN1214E5

To print letters single stroke and double stroke by freehand IN 7:4 and 5:4 & dimensioning

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

- **select and calculate the size of letters**
- **draw the layout for printing a letters and numerals, as height and width of letter**
- **print single stroke letters and numerals**
- **print double stroke letters and numerals.**

PROCEDURE

- Select the size of letters and calculate the height & width of each letter.
- Arrange and draw the guidelines for the required size.
- Prepare the layout for printing of letters
- Mark the width and spacing for each letters
- Draw vertical guide lines
- Print the letter by freehand, using H or HB pencil.

Fig 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.**

- Draw the table as shown in the figure.
- 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 adacent 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.

Dimensioning techniques

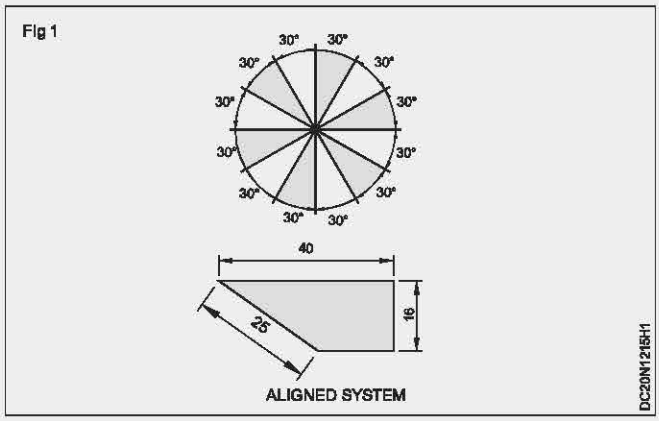
Objectives : At the end of this exercise, you shall be able to,
- **draw different systems of dimensioning**
- **dimension the drawings by aligned system and unidirectional system**
- **follow the standard of system of dimensioning with different arrangements of dimensional values.**

To show aligned system of dimensioning

- Draw the figures as shown (Fig 1).

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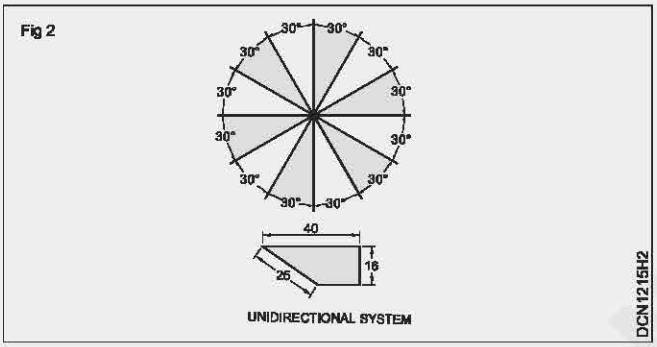
- Show the dimension lines in the figures.



- Place the dimension value above the dimension line centrally as direction.

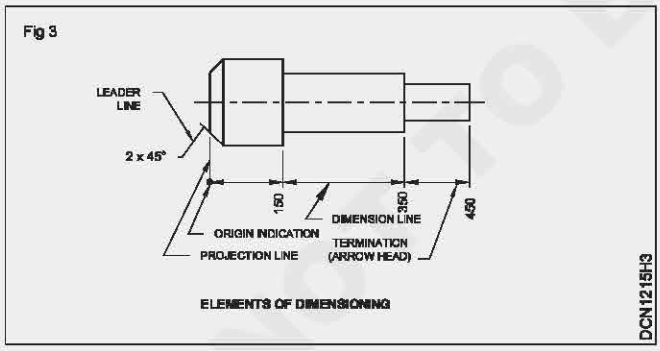
To show unidirectional system of dimensioning

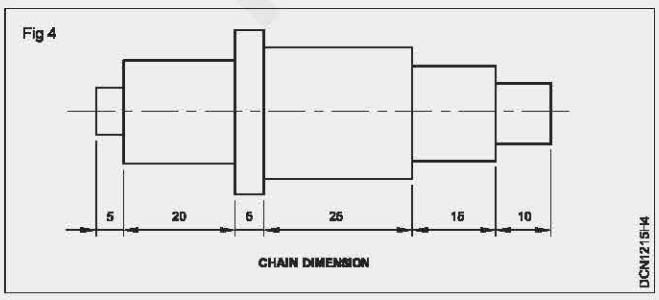
- Draw the figures as shown (Fig 2).

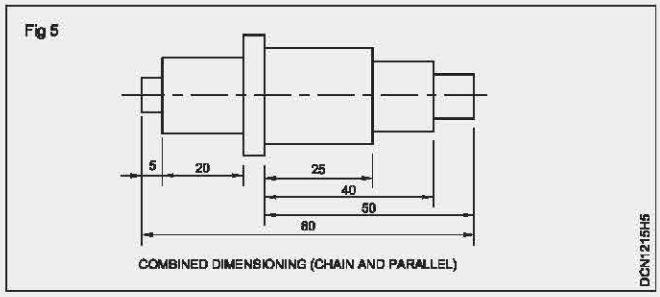


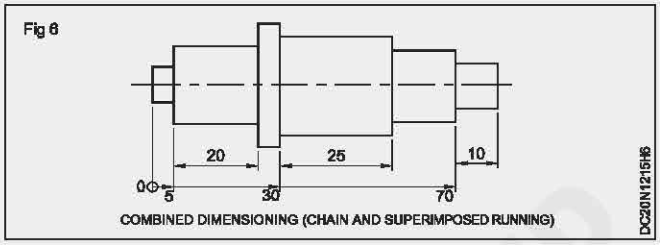
- Show the dimension lines in the figures.
- Cut the dimension line at center to place the dimen sion value horizontally.

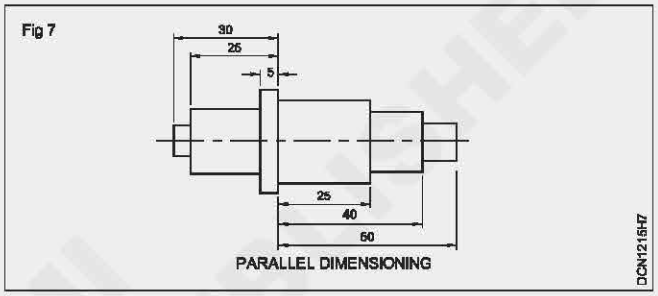
To show various notations used in dimensioning (Fig 3) to (Fig 9)

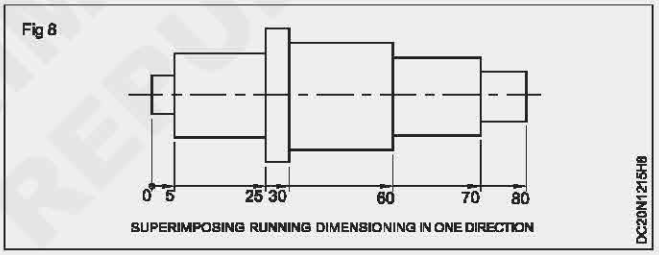


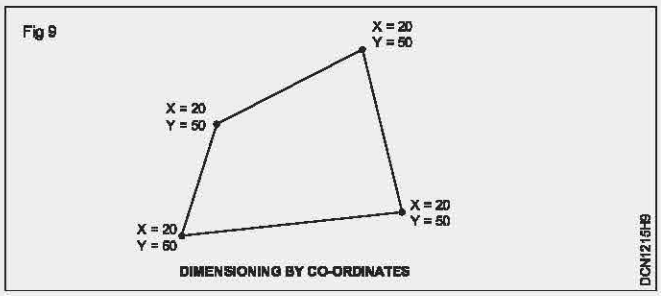












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Construction of plane geometrical figures

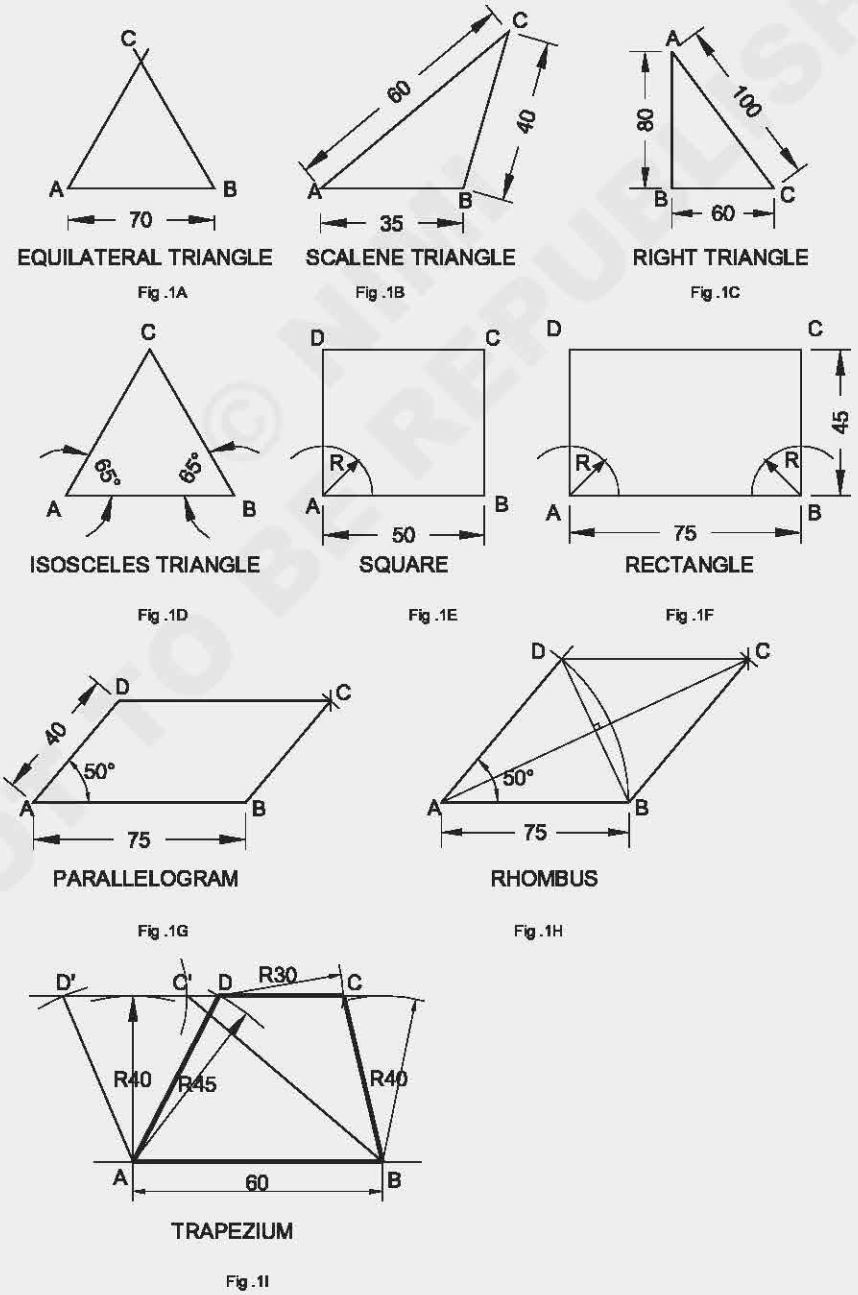
Objectives : At the end of this exercise you shall be able to
- **construct equilateral triangle**
- **construct a scalene triangle**
- **construct a right angled triangle**
- **construct an isosceles triangle**
- **construct various quadrilaterals.**

PROCEDURE

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

- Draw a horizontal line of length 70mm and name AB.
- From A, draw an arc as radius of length of line AB
- Similarly, from B draw an arc as radius of length of line AB to intersect the first arc.

Fig 1



DCN1216H1

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- Name the intersect point C.
- Joined AC and BC points with a line to form a triangle.
- 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

- Draw base line AB=35 mm
- 'A' as centre draw an arc of radius 60 mm
- 'B' as centre draw an arc of 40 mm, cutting the previous arc at 'C'.
- Join CA & CB ,ABC is the required scalene triangle

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

AB = 80mm, BC = 60mm

- Draw the horizontal line BC to length 60mm.
- Erect a perpendicular to length 80mm at B.
- Join AC
- ABC is the required right angled triangle

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

AB = 50mm and ∠CAB= ∠ABC= 65°

- Draw line BC = 50mm
- Set an angle 65°at A and B
- Extent the line meeting at C, ABC is the required an isosceles triangle.

TASK 5: **To construct quadrilaterals**

Constructing square (Fig 1E)

A square of side 50mm by erecting perpendicular.

- Draw a line AB 50mm long
- A as centre, draw an arc of convenient radius 'r' touching the line AB at 'P'
- 'P' as centre and radius 'r' draw another arc cutting the earlier draw arc at 'Q'
- 'Q' as centre and radius 'r', draw another arc 'R'.
- Bisect QR at S and extend.
- Mark 50mm on AS extended line. AD = 50mm.
- From points B and D, draw parallels to AD and AB and complete the square ABCD.

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

- Sides 75mm and 45mm
- Draw a line 75mm.
- From A and B, errect perpendicular .
- Mark C and D as AD=BC=45mm
- Join CD and complete the rectangle.

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

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

- Draw line AD equal to 40 mm and make one angle of 50° to AB.
- D as centre draw an arc of radius equal to AB.
- B as centre draw an arc of radius equal at AD, upwards such that they meet at a point 'C'.
- Join BC and DC. ABCD is the required Parallelogram.

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

- Draw two adjacent lines AB and AD equal to 75mm at 50^0 angle
- B and D as centres draw R75 arcs intersecting at C.
- 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.

- Draw the base AB equal to 60mm.
- With radius 40mm, draw arcs from A and B.
- Draw a tangential line (parallel to AB)
- Draw an arc with radius 45mm and A as centre, cut ting the line at two places D and D?
- From D or D? mark length of 30mm towards right side, mark it as C or C'.
- Join B and C or C'.
- Join A and D or D'.ABCD/ABC'D' is the Trapezium

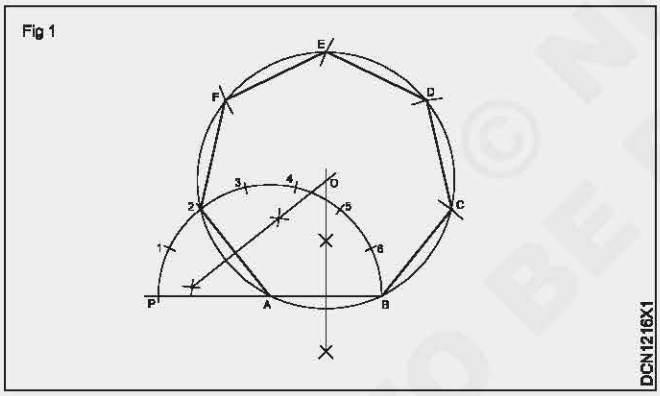
Try to construct all these figures with different methods as you can

To construct polygons

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

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

Semi-circular method - Type A (Fig 1)

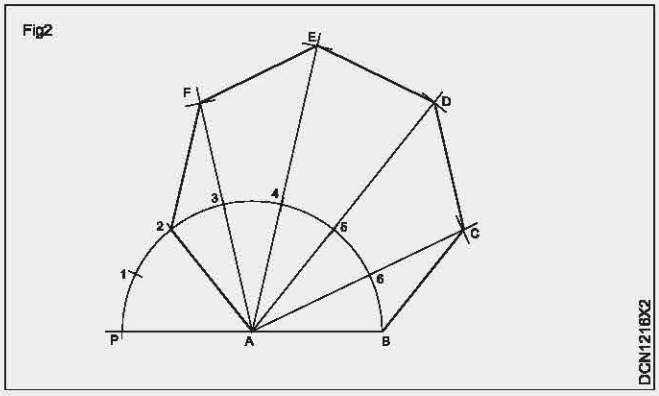


- Draw a line AB equal to 30 mm.
- Extend BA to a convenient length.
- A as centre and radius AB describe a semi-circle.
- Divide the semi-circle into seven equal parts (number of sides) using divider.
- Number the points as 1,2,3,4,5,6 starting from P.
- Draw the perpendicular bisectors from 2A and AB intersecting at 0.
- 0 as centre and OA or OB as radius describe a circle.
- Mark the points C,D,E,F and 2 on the circle such that BC = CD = DE = EF = F2 = AB = 2A.
- Join the line BC, CD, DE, EF and F2.
- ABCDEF2 is required heptagon.

Semi-circle method - Type B (Fig 2)

Follow the procedure of Type A upto dividing the semi-circle into number of equal parts.

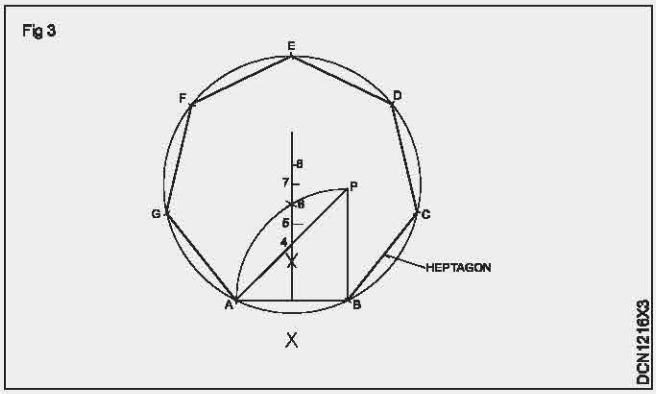
- Join A2
- Join A3, A4, A5 and A6 and extend to a convenient length.
- With centre B and radius AB draw an arc cutting A6 extended line at C.
- C as centre and same radius, draw an arc cutting the line A5 at D.
- Locate the points E & F in the same manner.
- Join BC, CD, DE, EF and F2.
- ABCDEF2 is the required heptagon.



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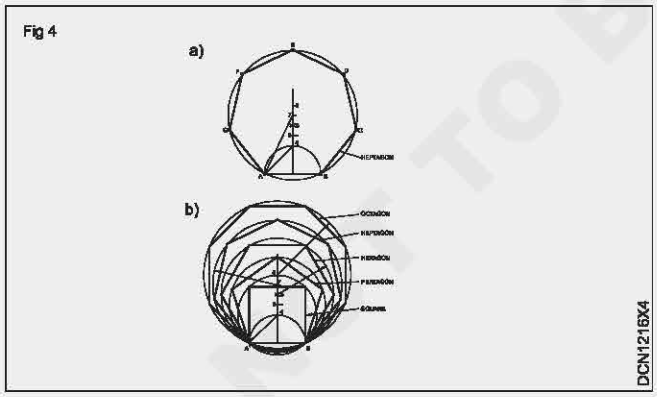
Perpendicular bisector method - Type A (Fig 3)

- Draw a line AB equal to 30 mm.
- At B, draw a line BP perpendicular AB and equal to AB.



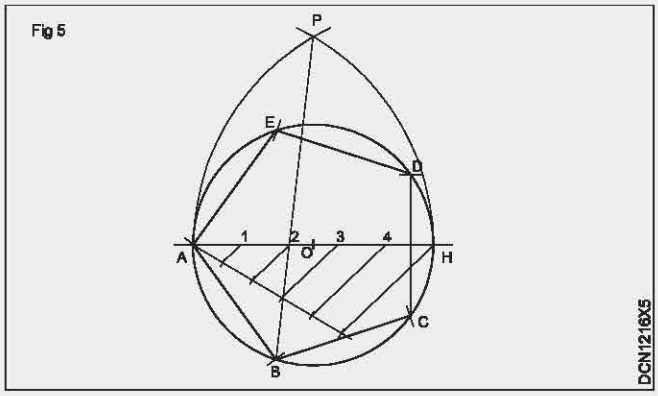
- Join AP
- B as centre BA as radius, draw an arc AP.
- Bisect AB and draw the bisector cutting the line AP and the arc AP at 4 & 6 respectively.
- Mark 5 the mid point of 4-6.
- Set off 6-7, 7-8, 8-9, 9-10 equals to 4-5.
- 7 as centre, 7A as radius, draw a circle on AB.
- On the circumference set off BC, CD, DE, EF, FG equals to AB.
- Join BC, CD, DE, EF, FG and GA.
- ABCDEFG is the required heptagon.
- Mark point 5 at the mid-point of 4 and 6.(Fig 4a) and complete the heptogon.

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



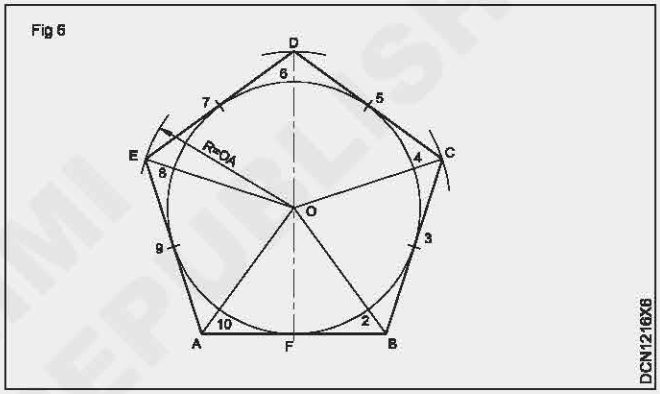
Pentagon inside a circle of diameter 80 mm (Fig 5)

- Draw the line AH equals to 80 mm. (Diameter of circle)
- `O' as centre OA as radius describe a circle.
- Divide AH into 5 equal parts (as many equal parts as the sides).
- A and H as centres, AH as radius describe arcs intersecting at P.



- Join P2 and extend it to meet the circle at B.
- Set off BC, CD, DE, EF equals to AB on the circle.
- Join the points
- ABCDEF is the required pentagon.

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



- O as centre and OF as radius describe a circle of dia 80 mm.
- Draw the line DF vertically beyond the top of the circle.
- Divide the circle into 10 equal parts. (Twice as many equal parts as the number of sides)
- Points 1,3,5,7 and 9 are the tangent points of the pentagon.
- Join 02, 04, 06, 08, 010 and extend to a convenient length.
- Draw a tangent to the circle through point 1 (F).
- The tangent cuts the lines 0-2 and 0-10 lines at A & B.
- Draw tangents on points 3,5,7,9 & locate C, D & E in the same manner.
- Join BC, CD, DE, EA
- ABCDE is the required pentagon.

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To construct plain scale,comparative scale, diagonal scale, vernier scale and scale of chords

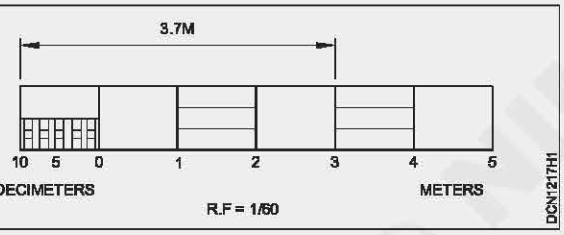
Objectives : At the end of this exercise you shall be able to
- **find out R.F of the scale**
- **calculate the length of scale on drawing**
- **construction of plain scales, comparative scales, diagonal scale and vernier scales**
- **mark the distance on the scale**
- **construct a scale of chords.**

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**

- R.F=Drawing size/Actual size=1cm/60cm=1/60
- Length of scale=R.F. x maximum length to be mea sured.
- length of scale=1/60x6m=1/10metre=10cm
- Draw a horizontal line of length 10cm (Fig 1).

Fig 1



- Draw a rectangle of size 10cmx0.5 cm.
- Divide the rectangle into 6 equal divisions, each divi sion representing 1m.
- 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,
- Divide the first main division into 10 equal sub- divi sions, each representing 1dm.

SOLVE THE PROBLEM BY YOURSELF

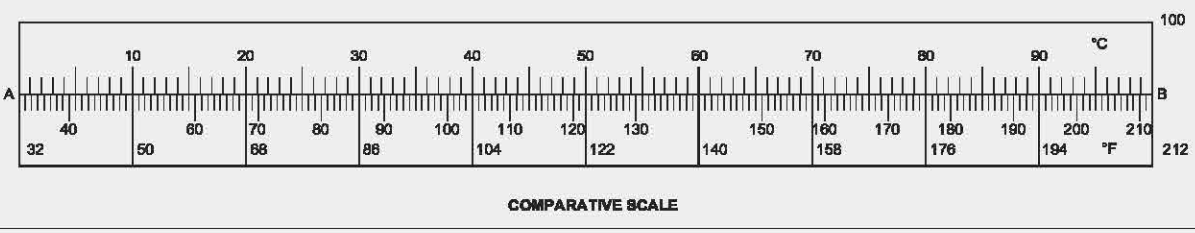
- Construct a plain scale of RF $\frac{1}{20}$ to measure upto 10cm (min) and mark a distance of 1.2 metres on the scale.
- Construct a plain scale of RF $\frac{1}{40}$ to measure metres and decimetres and mark a distance of 3.7m.
- Draw the lines for sub-divisions slightly shorter as shown.
- Draw thick and dark horizontal lines in the middle of all alternate divisions and sub-divisions. This will help in taking measurements.
- Below the scale , print METRES on the right hand side, DECIMETRES on the left-hand side, and R.F in the middle.
- Indicate on the scale a distance of 3.7 metres = 3 main divisions to the right side of 0(zero)+7sub-divi sions to the left of 0(zero).

— — — — — — — —

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

- Draw a line AB of 15 cm long. (Top part will read °C and bottom part will read °F)
- Divide the line into 10 equal divisions.
- 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.
- On °C side divide one division into 10 equal parts. (Now each small division represents 1°C)
- On °F side, divide each division into 18 equal parts. (Now each small division represents 1°F)
- Mark other numbers and complete drawing the scale.

Fig 2



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 3)**

Length of scale required = RF x length to be measured

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

- Draw a rectangle ABCD of 16 cm x 4 cm.
- Divide the rectangle ABCD into 4 equal parts and mark them EF, GH & IJ and each division represents one metre.
- Divide the line AB into ten equal parts and mark them $1_1, 2_1, 3_1 \ldots\ldots 10_1$.
- Draw Horizontal lines from points 1, 2..... etc.
- Divide the BF into 10 equal parts and mark them as 1'2'3' etc and each division representing 10 cm (1 dm).
- Draw diagonals on all ten small rectangles in the 1st (lower) block ABFE and complete the diagonal scale.
- 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 centrimetres are read on points where the diagonals intersect with the vertical parallel lines drawn through the divisions of line AB.
- Mark 2.69 in using the diagonal scale. (Fig 3)

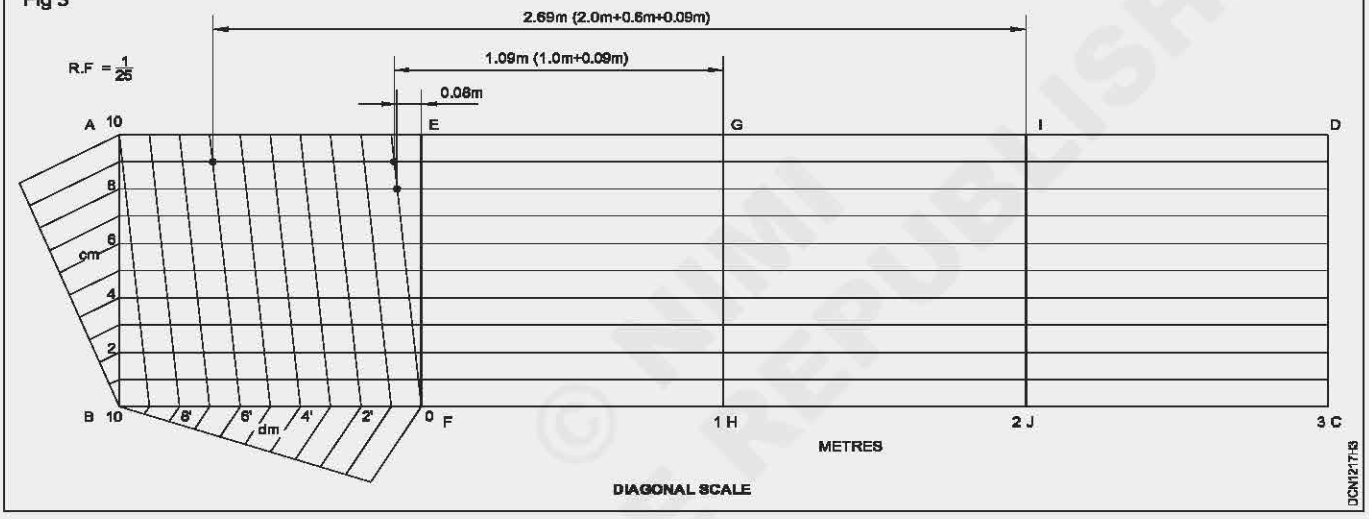
  2.00 m on metre division

  0.60 m on decimetre division

  0.09 in the diagonal cm division

  1.09 m and 0.08 m are also marked in the fig 3 in the same way.

Fig 3



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 4)**

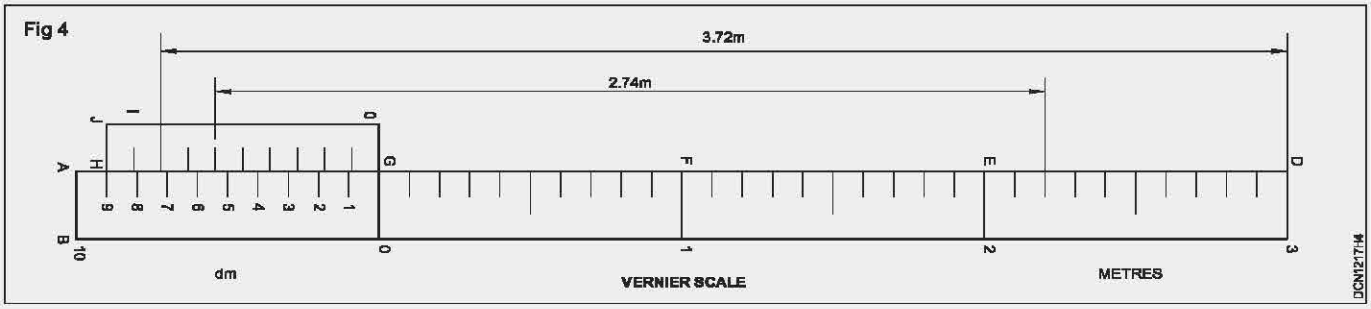
Length of scale = $\frac{1}{25}$ x 4m x 100 = 16 cm.

- Draw a rectangle ABCD (16 cm x 1 cm) representing main scale.
- 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)
- Add another rectangle GO, J, H as secondary scale (vernier) to a length of 9 MSD (9 dm).
- 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 4 is shown with more detail in Fig 5.

Fig 4



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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 (Fig 1)**

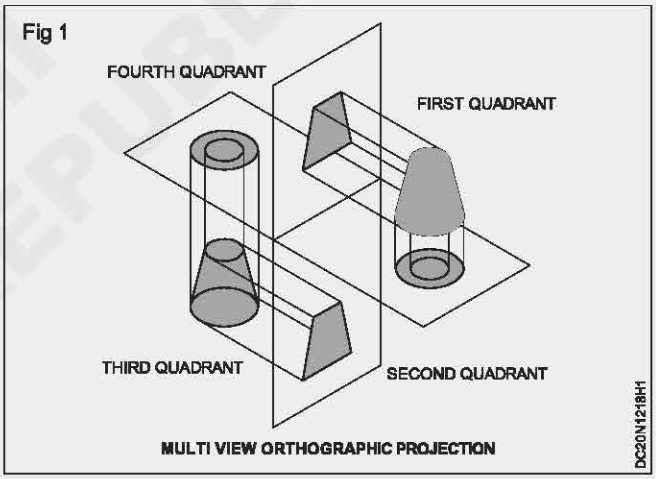
- Draw the views with reference to the front directions indicated.
- The view from top is placed underneath
- The view from bottom is placed above
- The view from the left is placed on the right
- The view from the right is placed on the left
- The view from the rear may be placed on the left or on the right as may be found convenient.

— — — — — — — —

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

- Draw the views with reference to the front directions indicated.
- The view from top is placed above
- The view from bottom is placed underneath
- The view from the left is placed on the left
- The view from the right is placed on the right
- 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 2 (a)**

— — — — — — — —

TASK 4: **Draw the plan, elevation side views in 3rd angle projection (Fig 2 (b))**

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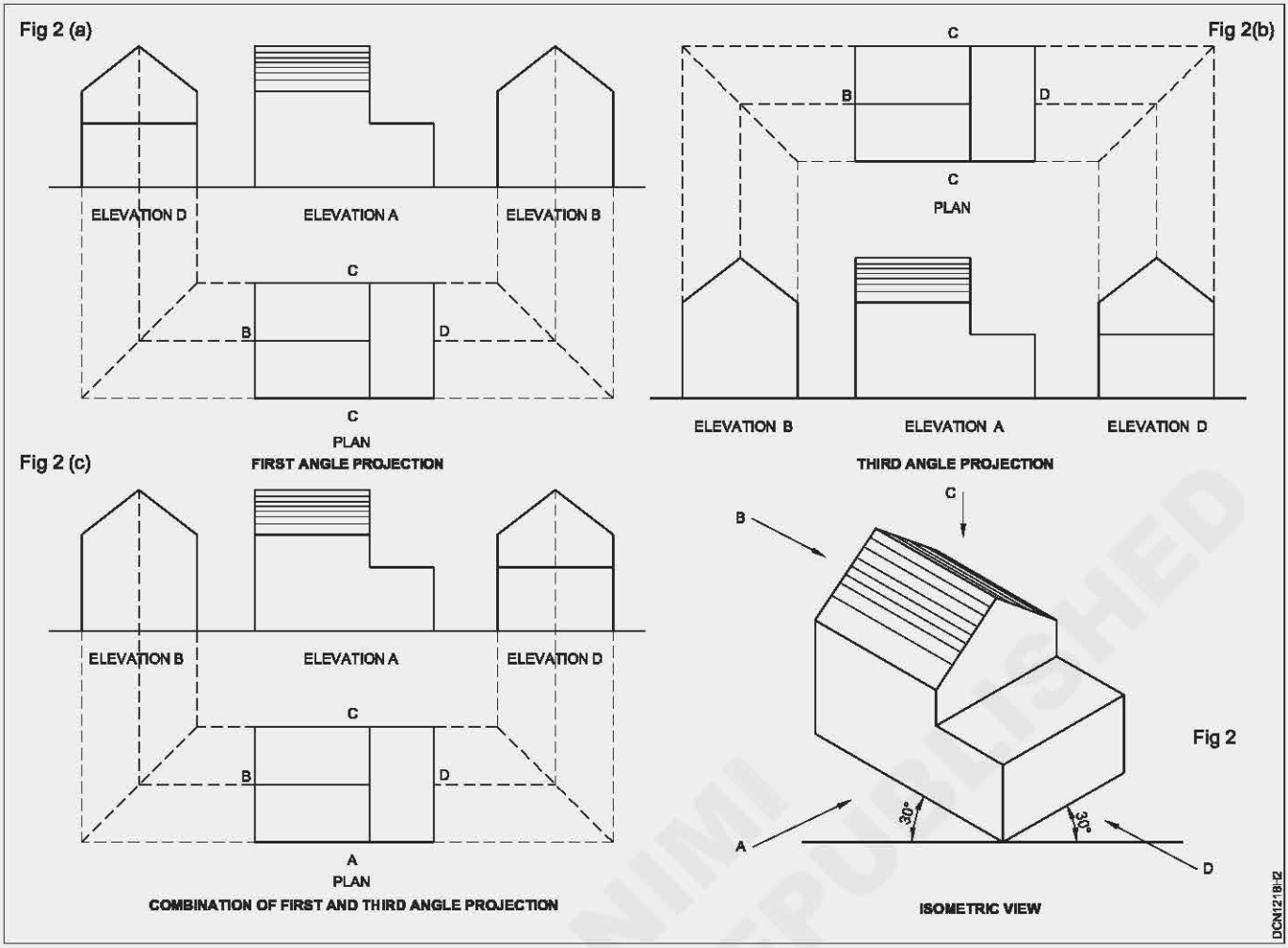
TASK 5: **Draw the combination of first angle and third angle projection of the object (Fig 2 (c))**

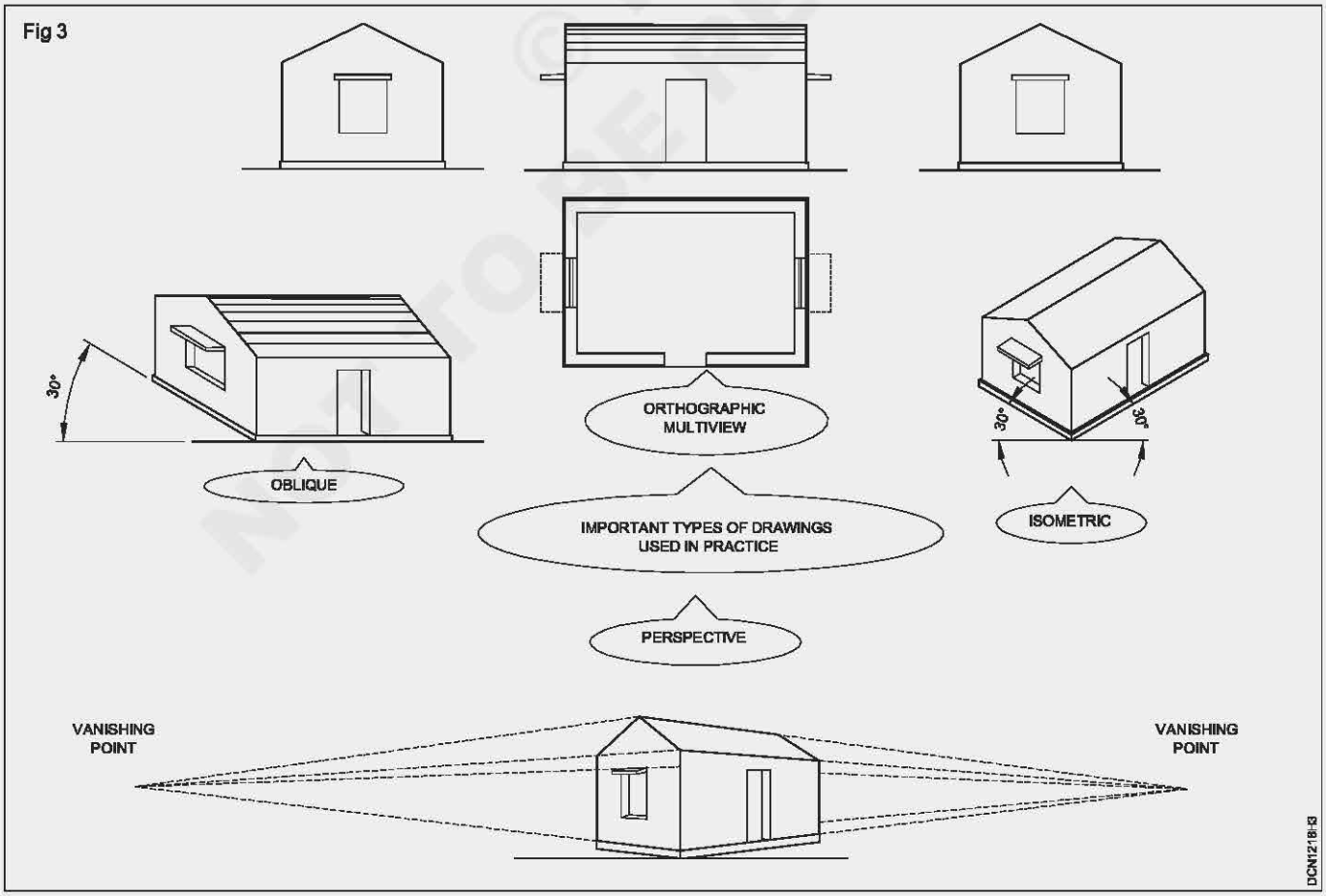
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TASK 6: **Draw the single room drawing (Fig 3)**

- Reproduce the single room drawing and study.

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Projections of lines

Objectives : At the end of this exercise you shall be able to
- **draw projection of lines in the first angle and third angle for the given positions.**

Draw the projections of a line on VPI, VPII and HP given its positions as in the table below:

S.No.	Line	Length of line	Distance from HP	Distance from VPI	Distance from VPII	Line inclined to HP	Line inclined to VPI
1	ab	40	30	40	20	Parallel	Parallel
2	cd	45	Nearest end point of Line 20 above HP	35	15	90° perpendicular	Parallel
3	pq	55	25	Farthest end point of line 75 in front of VP	20	Parallel	90° perpendicular
4	rs*	50	Nearest end point of line 15 above HP	40	60 mm to the point nearest to HP	30°	Parallel
5	mn	60	28	Nearest end point of line 15 from VP	33 mm to the nearest end point of the line	Parallel	55°
6	kl	70	Nearest end point of line 20 above HP	Nearest end point of line 25 in front of VPI	35 mm to the point nearest to VPII	Either 40°	or 50°
7	gh	70	-do-	-do-	80 mm to the point nearest to VPII	40°	50°

* Angle is measured positive in the anti-clockwise direction.

** Link KL is parallel to VPII

*** Line GH is not parallel to VPII

Exercise 1

- Draw lines XY and X'Y'.
- Draw a line ab (plan) at distance of 40 mm below XY and point 'b' 20 mm away from X'Y'.
- Draw a line a'b' 30mm which will be the elevation above XY and point b' is 20 mm away from X'Y'.
- Draw the projections from ab and a'b'. Projectors meet at a point a'' (b'') - the side elevation (Fig 1).

Exercise 2

- Draw the line XY and X'Y'.
- Mark the point d (c) - Plan 35 mm below XY and 15 mm to the left of X'Y'.
- Project the point d (c) upwards and mark point c' 20 mm above XY line.
- Mark point d' 45 mm above point c'.
- join points c'd (length of the line). Now line c'd is the elevation.
- Project c'd to the right and draw the side elevation c''d'' 35 mm away from the X'Y' line.

For the previous step 35 mm may be taken from a scale or transfered from plan d (c) by construction as shown in Fig 2.

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Fig 1

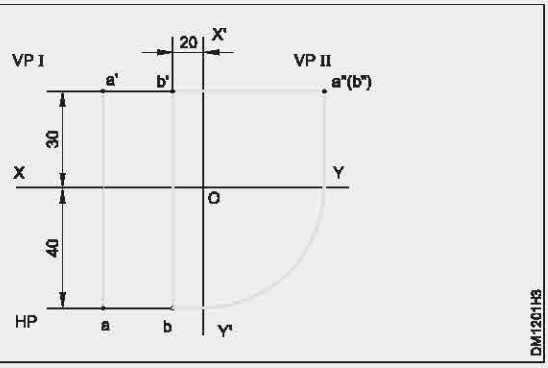
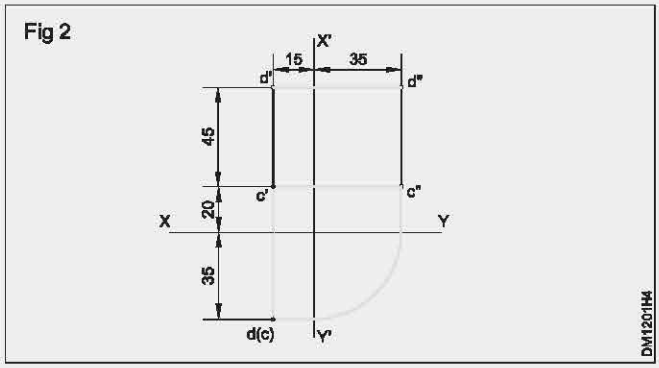


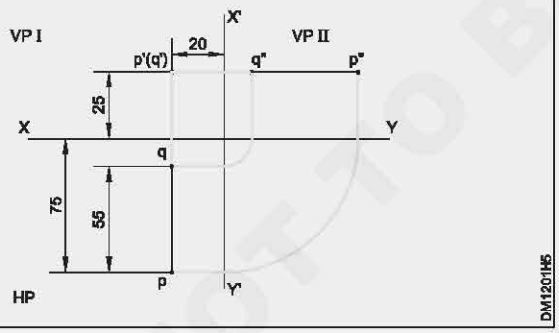
Fig 2



Exercise 3

- Draw the line XY and X'Y'.
- Draw pq (plan) of length 55 mm such that it is 20 mm away from X'Y' and point P is 75 mm below the XY line.
- Project pq vertically upwards and mark p' (elevation) on it and 25 mm above the XY line.
- The side elevation p''q'' is drawn by projecting p' to the right and transfering the distance pq as shown (Fig 3).

Fig 3

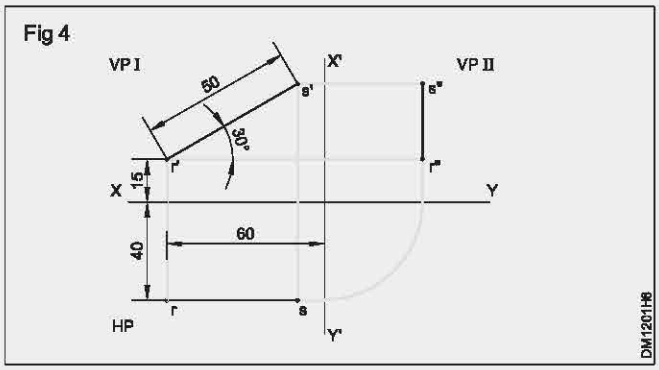


Exercise 4

Note : In this problem, elevation on r's will be of r's will be of actual length (50 mm) at 30° to XY. Plan and side elevation will be shorter than actual length.

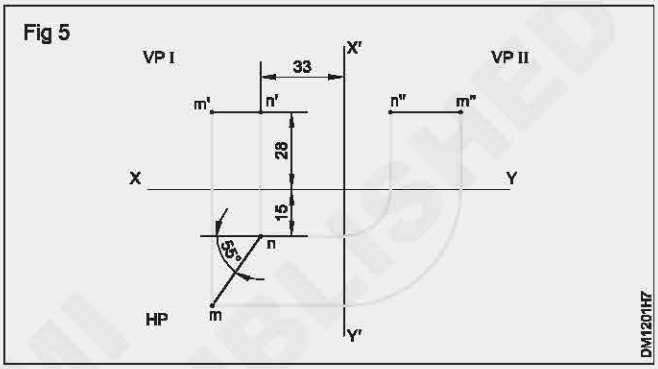
- Draw the elevation r's at an angle 30° and of 50 mm long, with the point r'15 mm above XY line and 60 mm to the left of X'Y'.
- Project r's downlwards and draw rs the plan at a distance 40 mm below the XY line.
- Draw the projectors from r's' and rs as shown and draw the r''s''-the side elevation (Fig 4)

Fig 4



Exercise 5 (Fig 5)

Fig 5



Note: Since the line is parallel to HP, projection on HP will be of true length and it will be at an angle of 55° to XY line.

- Draw the line mn (plan) such that it makes an angle of 55 to XY line and is of 60 mm in length.
- Draw the elevation m' n' and side elevation m''n'' as given in the earlier exercise.

Exercise 6

Note: Since the line is parallel to VPII, projection of VPII will be of true length and it will be at an angle of 40 as the inclination of the line to HP is 40.

- Draw k''l'' to length of 70 mm, inclined 40 to XY with point k'' is 20 mm above XY and 25 mm away from X'Y'.
- Draw k'l' (elevation) 35 mm away from X'Y' by projecting points k'' and l''.
- Draw plan kl by drawing projectors from side elevation and elevation (Fig 6).

Note: In this example projection of the line in all the three plane will be shorter in length than the actual length.

Exercise 7

- Draw the line gk and g'k', the plan and elevation of the line if it was parallel to VP and inclined 40 to HP.

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Fig 6

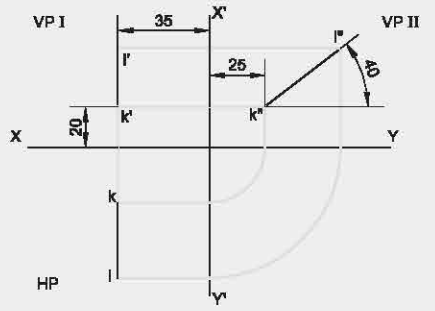
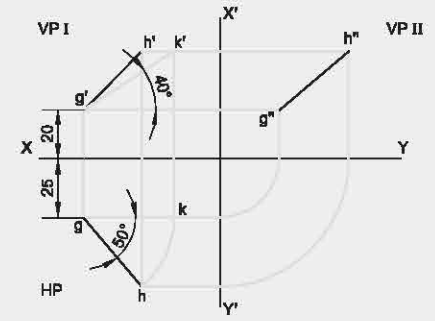


Fig 7



- Draw a line gh an angle of 50° to gk and of same length as gk. Now gh will be the plan when the line makes 50 to VP.

Hint: The projected length of a line, when projected to one principle plane to which it is inclined will be of same length, no matter what angle it makes with the other principle plane.

- Get the point h' by drawing horizontal projectors through k' and vertical projector through 'h'.
- Join g'h' and this will be required elevation of VPI.
- Get the point h'by drawing horizontal projectors through k' and vertical projector through 'h'.
- Join g'h' and this will be the required elevation on VPI.
- Get points g''h'' by drawing projectors from plan and elevation.
- Join g''h'', the side elevation (Fig 7).

Drawing the projection of plane figures (Lamina)

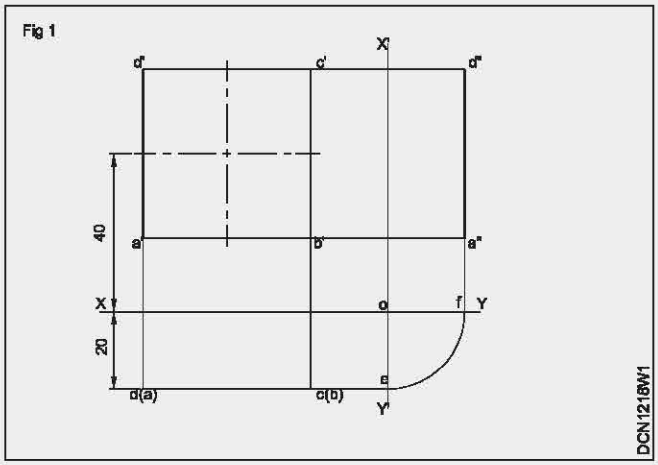
Objectives : At the end of this exercise, you shall be able to,

- **draw projections of surface, when they are parallel to one plane, but perpendicular to the other plane**
- **draw projections of surface when they are inclined to one plane, but perpendicular to the other plane**
- **draw the projections of surface when they are perpendicular to both the planes**
- **draw the projections of surface when they are inclined to both the planes**

TASK 1: **(Square of 60 mm side) (Fig 1) Draw the projections (elevation, plan and side view) of the square having its position defined under as**

- Surface parallel to VP
- Surface perpendicular to HP
- One of its edges parallel to HP
- Centre point 40mm above HP and 20mm in front of VP
- Draw the xy line.
- Draw the square with its centre 40 mm above the xy line and one edge parallel to xy line.
- Mark the corners of the figure a', b', c' & d'. This will be the elevation of the square.
- Draw the vertical projectors from a'b' downward beyond the xy line.
- Draw a horizontal line dc at a distance of 20 mm below the xy line. Line dc will be the plan.
- Draw a X'Y' line at a convenient distance from b'c', intersecting the xy line at 'O'.
- Project the plan to the X.Y. line meeting at e.
- By arc method transfer Oe to xy and mark the point 'f'.

Fig 1



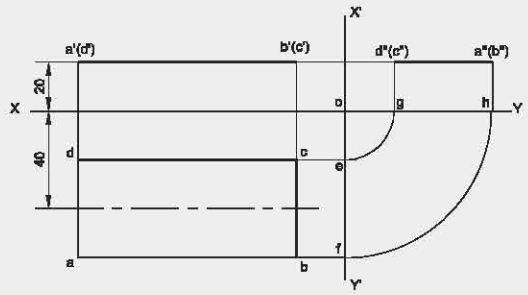
- Project 'f' upwards.
- Project b' and c' to meet the the projected line from 'f' at a'' and d'' respectively. Now the line a''d'' is the side view.

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TASK 2: **Draw the projections (elevation, plan and side view of a rectangle having the position defined as (Rectangle of 40 mm x 80 mm) (Fig 2)**

- Surface parallel to HP
- Surface perpendicular to VP
- One of its edges parallel to VP
- Centre point 20mm above HP and 40mm in front of VP
- Longer side parallel to xy.
- Draw the xy line.
- Draw the rectangle with its centre 40 mm below xy line and its longer side parallel to xy. Mark the corners as a,b,c & d and join them.
- Figure a,b,c,d will be the plan.
- Draw the vertical projectors from d and c upwards beyond xy line.
- Draw a horizontal line a'b' at a distance of 20 mm above xy line.
- Now the line a'b' will be the elevation.
- Draw a vertical line x'y' line at a convenient distance from b'.
- Project c and b, meeting x'y' line at ef.

Fig 2

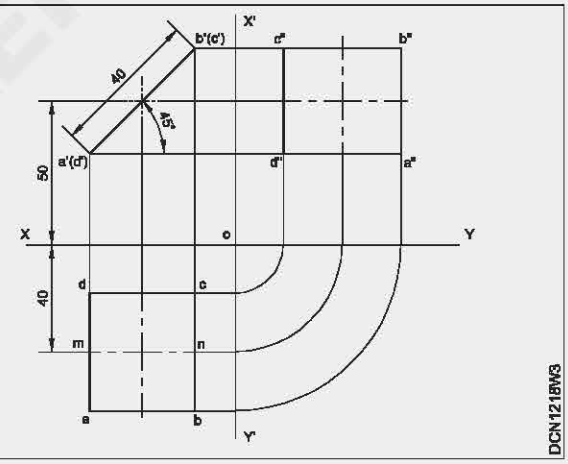


- By arc method transfer the point e & f to xy line and mark g & h respectively.
- Project the points g & h upward beyond xy line.
- Project a horizontal projectors from the point b' intersecting the vertical projectors, projected from g & h at d'' & a'' respectively.
- Now the line d''a'' is the side view.

TASK 3: **Draw the projection (elevation, plan and side view) of the square having its position defined as (Square of 40 mm side) (Fig 3)**

- Surface inclined to HP at on given angle 45°
- Surface perpendicular to VP
- One of the edges perpendicular to VP
- Axis major on it perpendicular to VP
- Centre point 50mm above HP and 40mm in front of VP
- Draw xy, X'Y' axis.
- Draw a'b' equal to the side of the square (40) at 45° and its centre point 50 mm above xy.
- Now a'b' is the elevation.
- Project a'b' downwards beyond xy line.
- Draw centre line mn at a distance of 40 mm below xy.
- Mark points a,b,c & d at a distance of 20 mm above and below and project a'b' down and complete the rectangle a,b,c,d and this will be the plan.
- Draw the projectors from elevation and plan.

Fig 3



In this exercise we have started with the elevation as the true length of the side will be available in the elevation.

The plan and side view are rectangles one side is equal to 40 mm and another side is fore-shortened and complete the side view d'',a'', b'' & c'' as shown in Fig 3

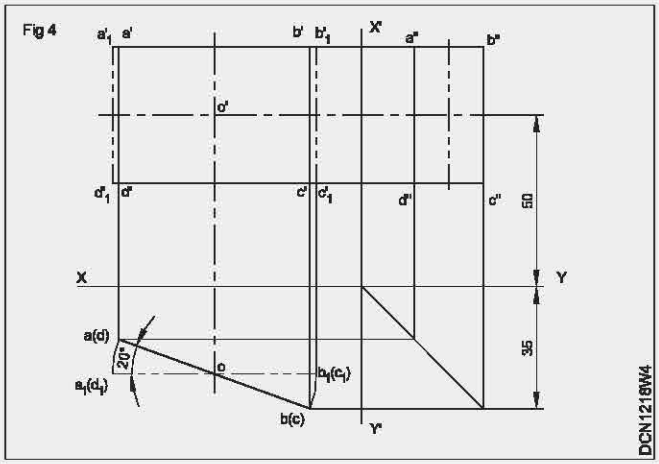
TASK 4: **Draw the projection (plan, elevation and side view) of a rectangle given its position as (Rectangle of 60 mm x 40 mm) (Fig 4)**

- Inclined to VP at a given angle 20^0
- Surface perpendicular to HP
- One of its edges perpendicular to HP
- Centre point 50mm above HP and 35mm in front of VP

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Surface perpendicular to HP, standing on its longer edge and also rotated about the vertical centre line to an angle. (say 20°)

- Since the surface is perpendicular to HP and inclined to VP the true length of the rectangle will be shown in the plan.
- Draw xy and X'Y' lines.
- Draw the plan and elevation as if the rectangle is parallel to VP and perpendicular to HP.
- Mark the centre point `0' and draw the plan ab in the rotated position. (i.e. 20°)
- Project the point a & b and complete the elevation a'b'c'd'.
- Complete the side view a''b''c''d'' by drawing the projectors from plan and elevation.



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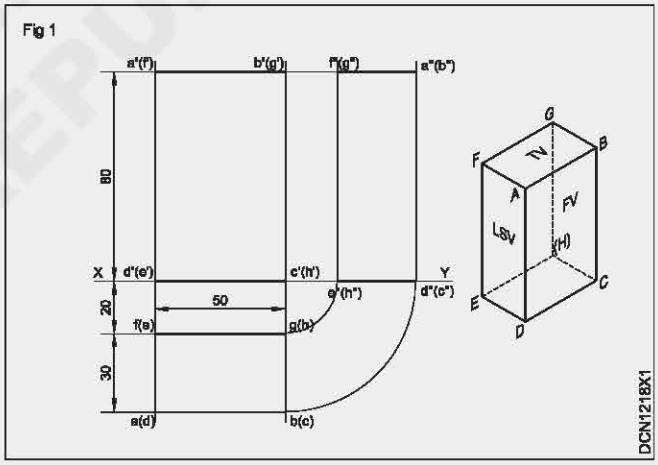
Projection of solids

Objectives : 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)**

- The base 50 x 30 is resting on HP.
- The vertical face 80 x 50 nearest to VP is 20 mm in front of it.

  Note: In this problem the face of prism are parallel to the planes of projection. Therefore the plan, elevation and side view will be rectangles.
- The prism is shown pictorially in the figure and its eight corners are marked as abcd-efgh.
- Draw the plan (50 x 30) 20 mm below XY line.
- Project from plan and draw elevation (80 x 50)
- Draw the side view by drawing projection from elevation and plan. (Fig 1)

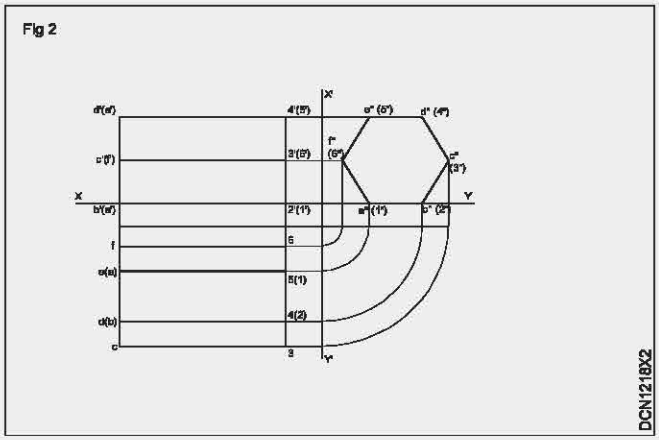


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TASK 2 **: Draw the plan, elevation and side view of an hexagonal prism whose side is 25 mm and length 60 mm given its position as below (Fig 2)**

- One of its lateral surfaces lying on HP
- The axis is parallel to vertical plane. The elevation. (In the elevation two lateral faces are visible, but they are fore-shortened)
- 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)



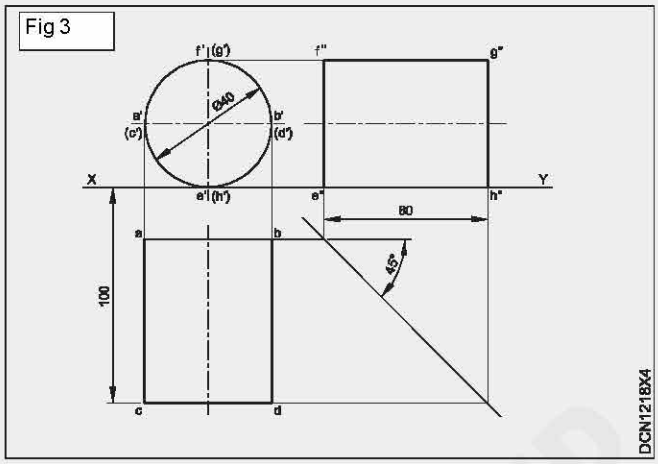
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TASK 3 :**Draw the plan, elevation and side view of a cylinder of diameter 40 mm and length 80 mm given its position as below (Fig 3)**

- Cylinder resting on the HP with its axis perpendicular to VP.
- Face farthest from VP is 100 mm away from VP.

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

- Draw the circle of diameter 40 mm touching XY line. (Fig 3)
- Draw the plan projecting it from the elevation.
- Draw the end view by drawing projection on it, from the plan and elevation.



Section of solids

Objectives: 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.**

Exercise 1

Draw elevation, sectional plan and the true shape of the section of a square prism.

- Length of side of square prism standing vertically.
- One diagonal of the base is perpendicular to VP and another diagonal parallel to VP.
- 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)

- Draw the cutting plane in the elevation of the drawing.
- From the point m' draw projector to meet the plan at mn.
- Hatch the portion of the plan and complete the required sectional plan.

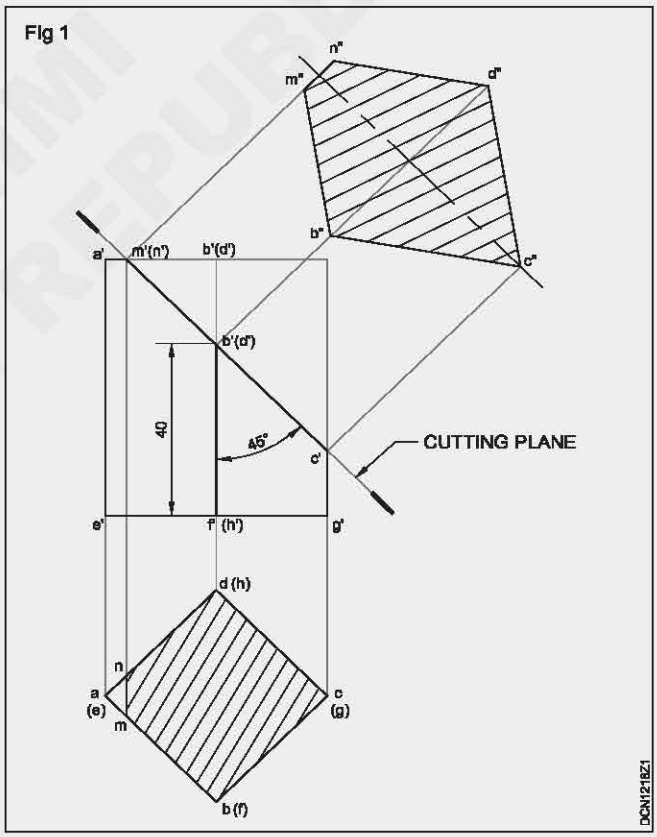
To get the true shape

- Draw a line parallel to the cutting plane.
- Draw projectors perpendicular to the cutting plane from points m', b' & c' and extend beyond the line, drawn parallel to the cutting plane.
- Transfer the distances mn and db symmetrically about the line and also mark c''.
- Join m''-n'', n''-d'', d''-c'', c''-b'' & b''-m'' and hatch the area to complete the required true shape. (auxiliary view)

Exercise 2

Draw the sectional plan, elevation and true shape of the cut surface of a cylinder given the details as under.

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



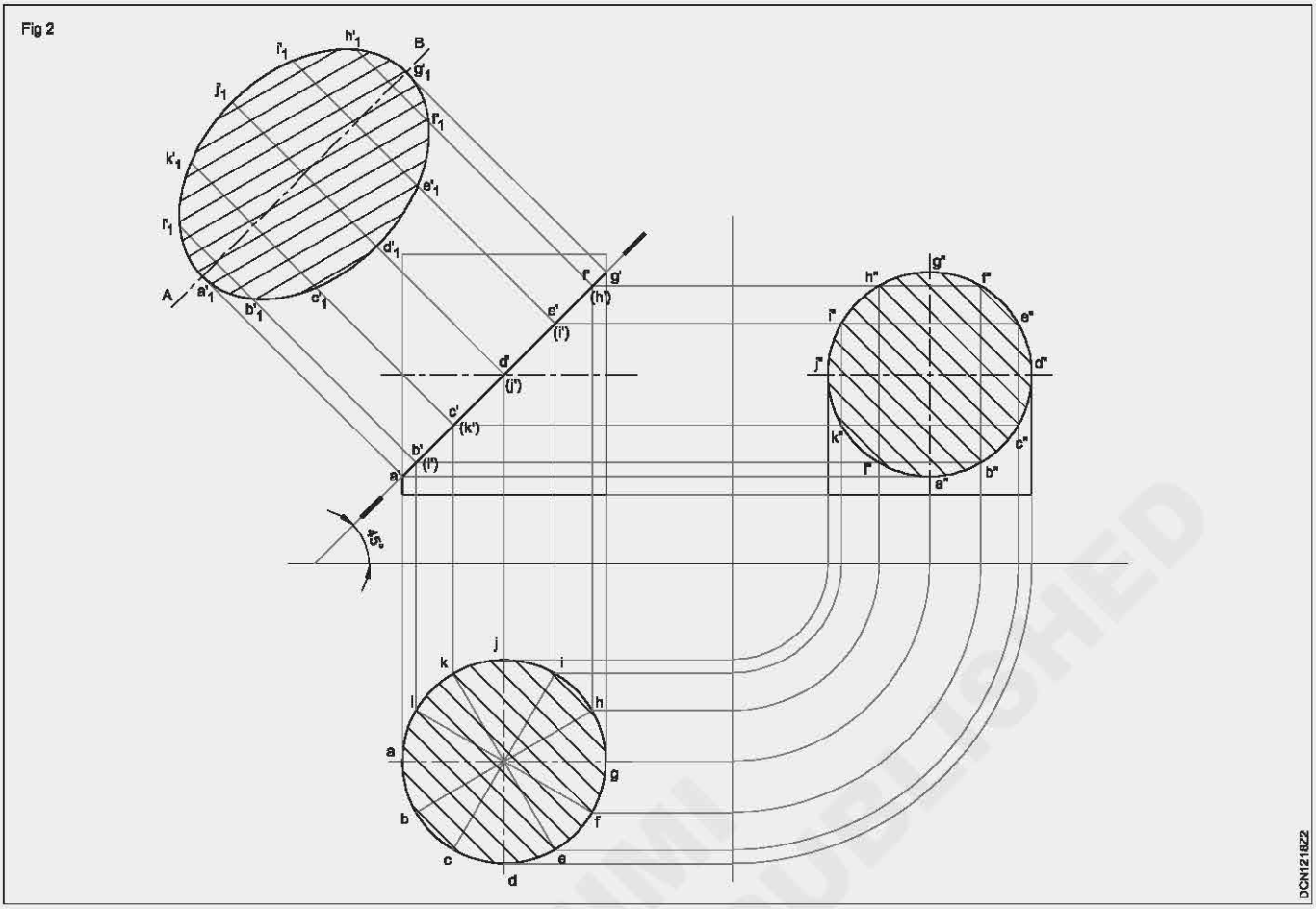
- Cutting plane makes 40° to the horizontal and intersecting the axis at the mid-point of the vertical axis.

Draw the plan and elevation of the cylinder. (Fig 2)

- Indicate the cutting plane in the elevation.
- Divide the plan into any number of equal parts, (say 12) and mark the points a, b, c... l.

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Fig 2



- Project the points a to l vertically to intersect the cutting plane line at a' b' c' etc.
- Project horizontally the points a, b, ... l in the plan by transfer method for the side view.
- Mark the intersection points of the corresponding projection in the previous two steps and complete the end view.

To draw the true shape of the section

- Draw a line AB parallel to the cutting plane line.
- Draw perpendicular projectors perpendicular to the cutting plane line.
- From points a', b', c' extend beyond the line AB.
- 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 points 2-6, 3-5 by transfering 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 projections of geometrical solids

Objective: 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.**

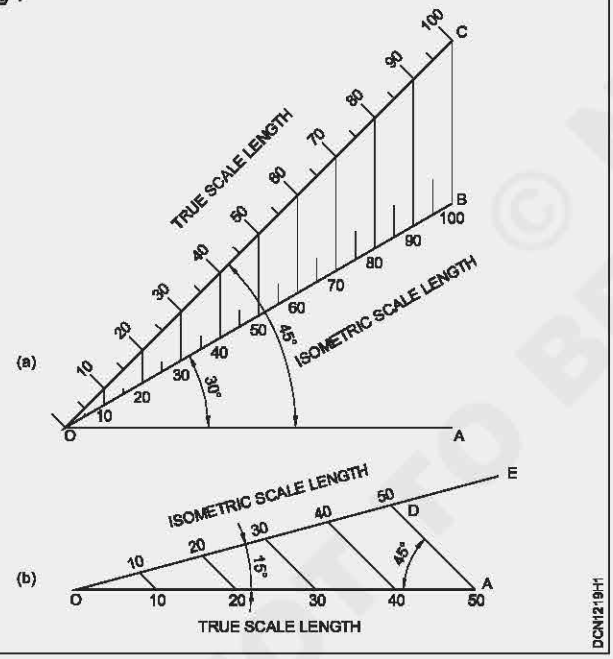
PROCEDURE

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

- Draw a horizontal line OA.
- Draw a line OC at 45° to OA and mark 10 mm, 20 mm.....100 mm.
- Draw another line OB at 30° to OA.
- Draw vertical projectors from divisions on OC on to OB and mark the divisions as on OC.

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

Fig 1



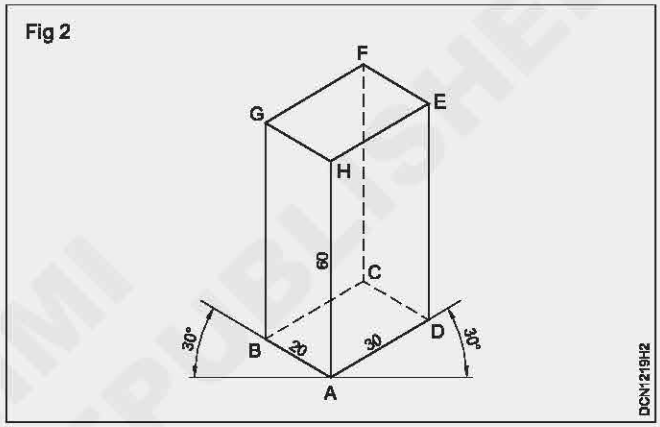
Another way of constructing isometric scale.

- Draw a horizontal OA to a known length.(say 50mm)
- Draw another line OE at 15° to OA.
- Draw another line from point A making 45° and meet the line OE at D.
- Divide the line OA into number of equal divisions (say 5) and mark 10,20,30,40 and 50 mm.
- From the points on the line OA, draw lines parallel to AD and mark off 10,20,30,40 and 50 on line OE.

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)

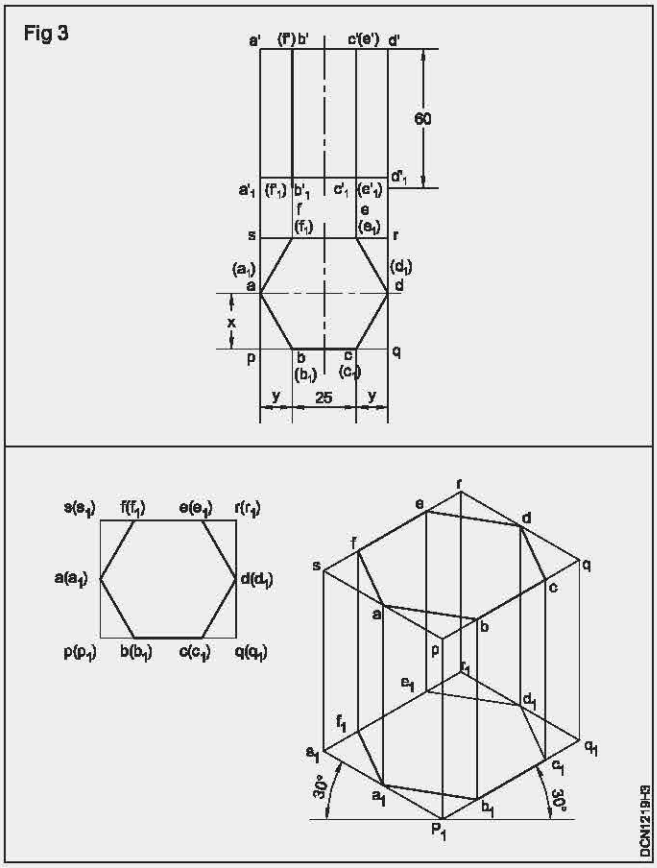
- Draw a hexagon of side 25 mm of its edge is horizontal.
- Draw a rectangular prism of base pqrs and height 60 mm.
- Draw the isometric view of the hexagonal base abcdef of the prism using offset method.
- Draw the top hexagonal face by drawing projection from the corners of the base.
- Make the visible edges by drawing thick lines and draw the invisible edges in hidden line.
- Rub off the unwanted lines and complete the isometric projection.

Use isometric scale for all measurements. (Fig 3)

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.

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Fig 3



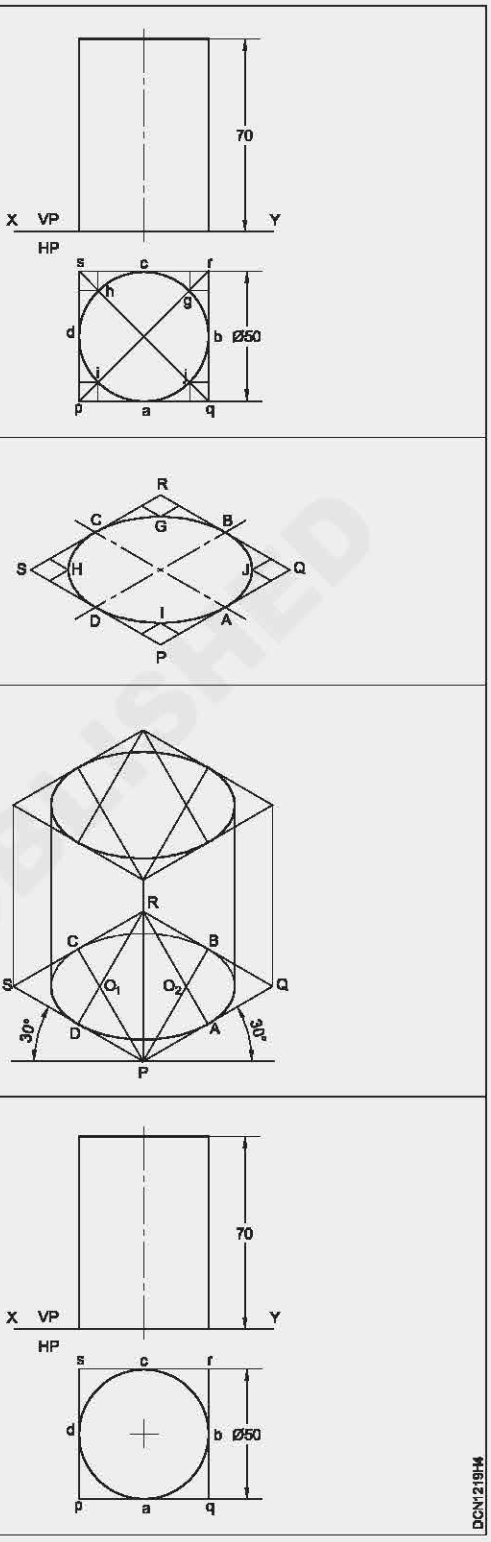
Off-set method

- Draw the elevation and plan of the cylinder. (Fig 4)
- Draw the isometric projection of a square of side equals to the dia of cylinder. (Fig 4a)
- Draw the isometric projection of a square prism of height 70 mm on the square drawn.
- 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.
- Draw the isometric circles for the bottom and top face of the cylinder inside the square prism using offset method.
- Draw common tangents to top and bottom isometric circles.
- Complete projection by drawing visible lines thick and invisible lines thin. (Fig 4b)

Four Centre arc method

- Draw the elevation and plan of cylinder. (Fig 4c)
- Draw the isometric projection of a square of side equals to the dia of cylinder.
- Draw the isometric projection of a square prism of height 70 mm on the square drawn.
- Draw the bisectors RD and RA from R and PC and PB from P.
- Draw arcs with O_1 and O_2 as centres and radius O_1D and O_2A

Fig 4



- Draw arcs with P and R as centres and radius PC and RD.
- Draw vertical lines from the end of the ellipse.
- Draw the base as half of the ellipse.
- Complete the isometric view of the prism.
- Follow the procedure of the cylinder in vertical position and complete the prism.

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Construction of solid figure

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

- To draw the following blocks (Figs 1 to 5) the procedure adopted in previous exercises and complete each isometric view of the block.
- Remove the unwanted lines, draw the remaining in thick and as required.
- Incorporated all the dimensions shown in the figure.

Fig 1

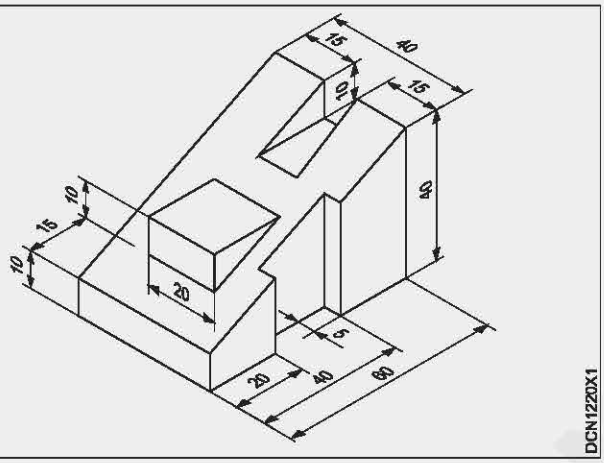


Fig 2

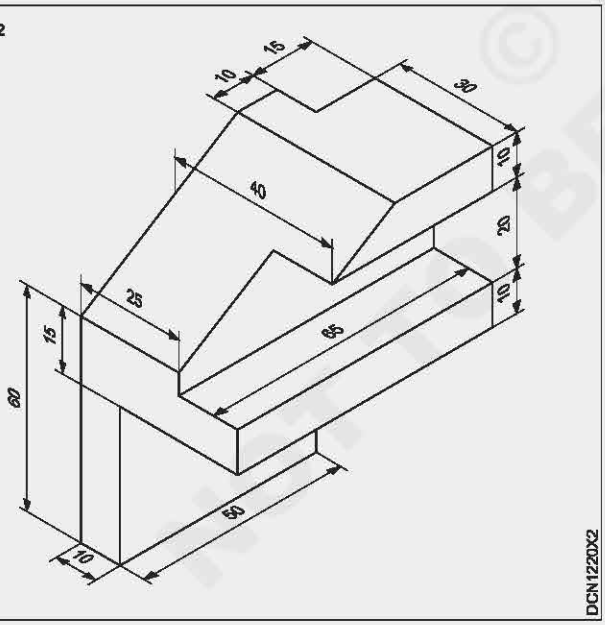


Fig 3

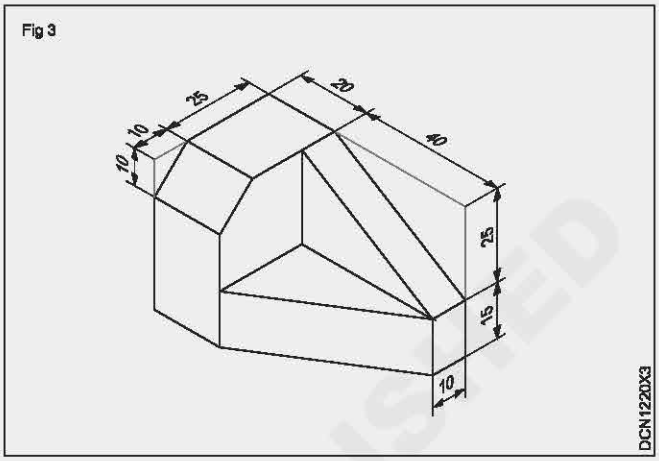


Fig 4

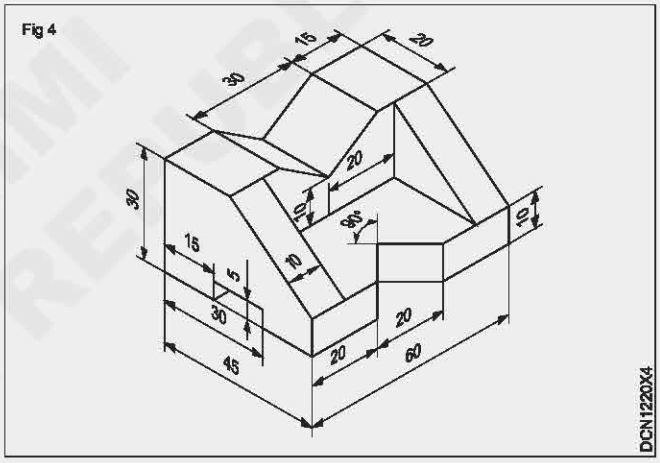
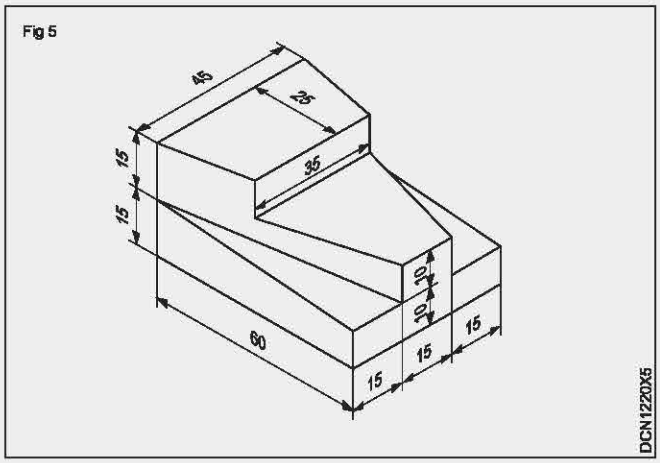


Fig 5



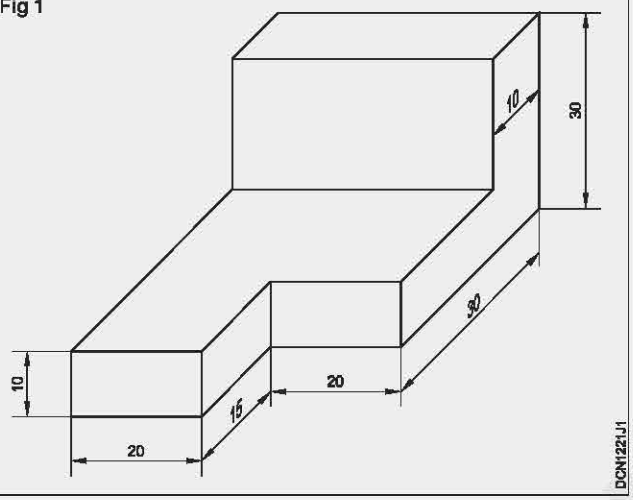
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Oblique projections and perspective view of a stepped block

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

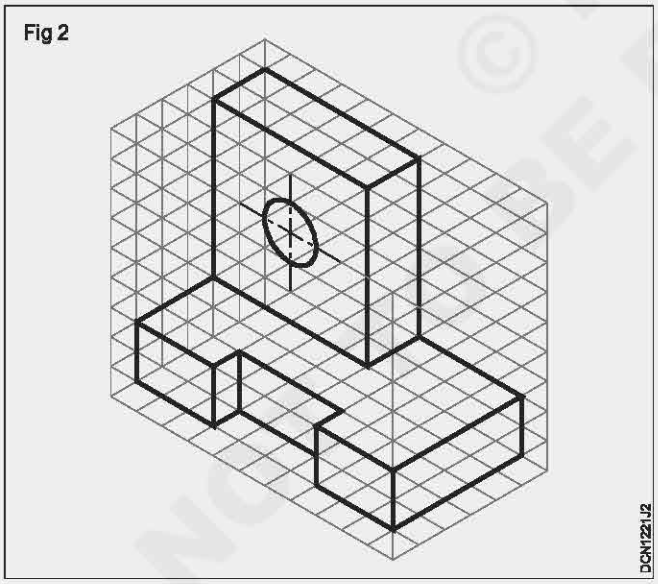
Ex.1: Reproduce the oblique view of the object shown in Fig 1.

Fig 1



Ex.2: 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



Ex.3: Draw the oblique view of the bracket (Fig 3) by cavalier method.

Ex.4 : Reproduce the oblique projection of the object shown in Fig 4.

- Draw the oblique axes (may be at any angle to the horizontal 30°, 45° or 60°) and extend. (Fig 4)
- Mark off the overall length, breadth and height of the object on the axis.

Fig 3

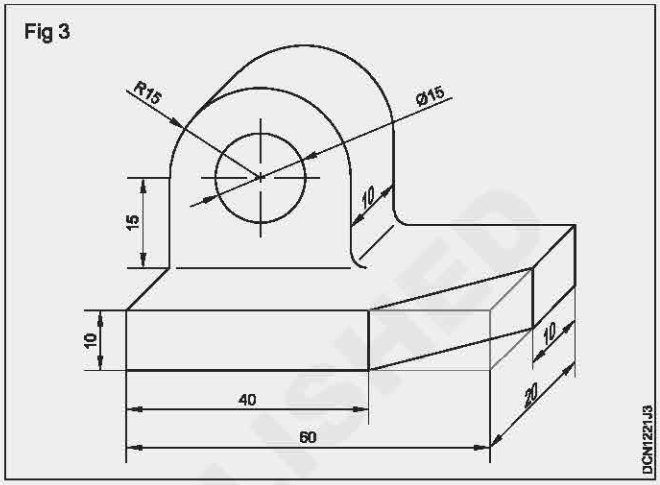
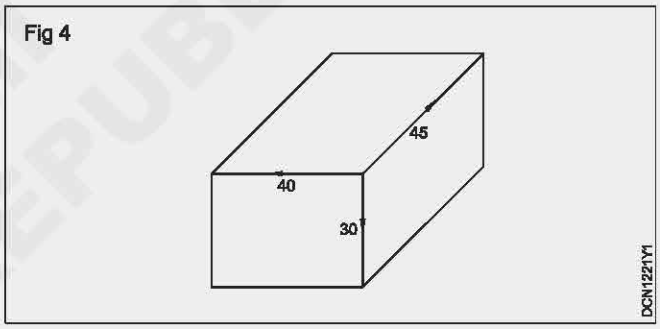
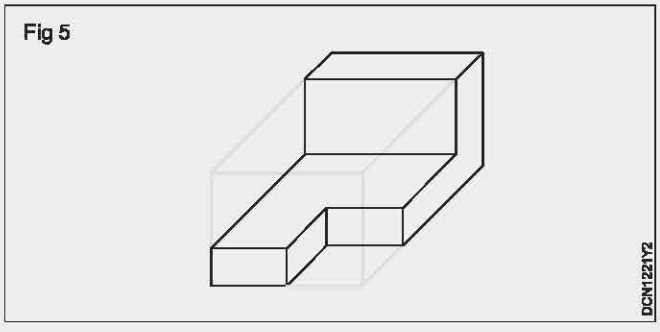


Fig 4



- 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 surfces. (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)

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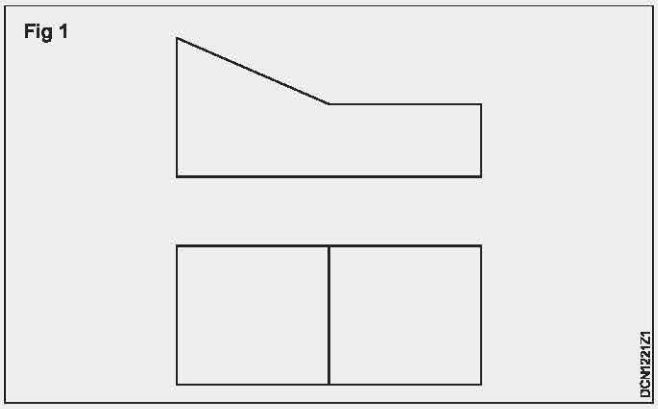
Draw the Perspective projections

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.**

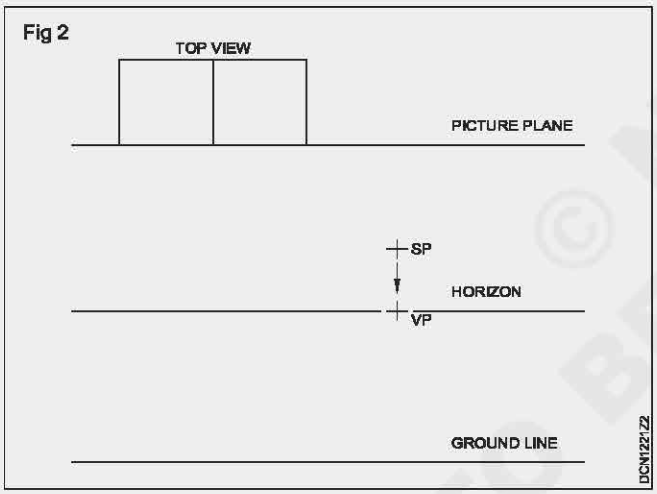
Draw the single point perspective view of the given object whose views are given in Fig 1.

Fig 1



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

Fig 2



- Locate the station point in a convenient position as desired.
- Mark the ground line and the line of horizon plane, where the pictorial drawing is to be drawn.
- Locate the station point by projecting the station point perpendicular to the horizon.

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

- From the station point, draw lines from each corner of the object as shown in Fig 3.
- Draw the projectors from the station point to the other corners of the top view. (Fig 4)
- From the vanishing point draw lines from each corner of the object as shown in (Fig 4)
- Project the points where the visual lines cross the picture plane in the top view to the pictorial view. (Fig 5)

Fig 3

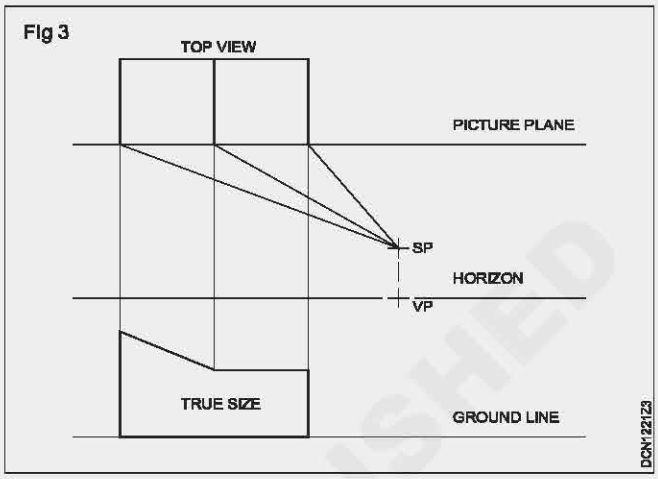
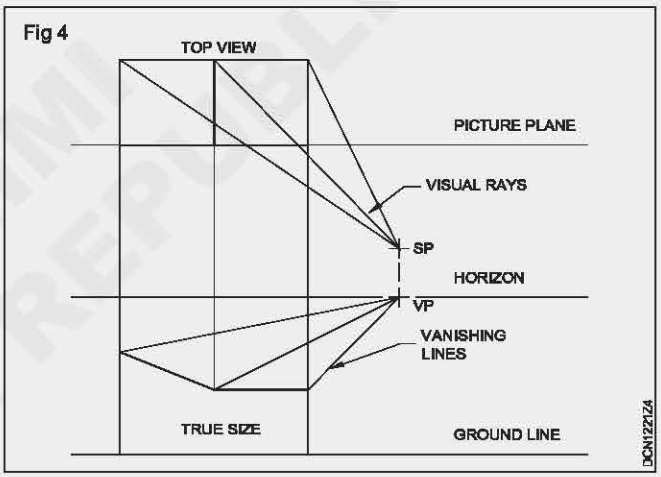


Fig 4



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

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

- Draw the edge of the picture plane.
- Draw the top view of the object at an angle to the picture plane. (Fig 8)
- Mark the station point.

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Fig 5

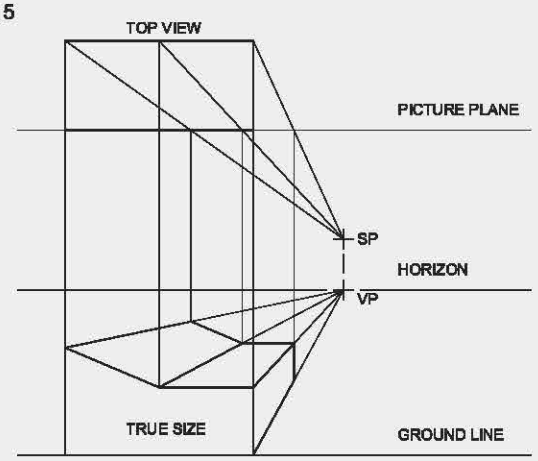


Fig 6

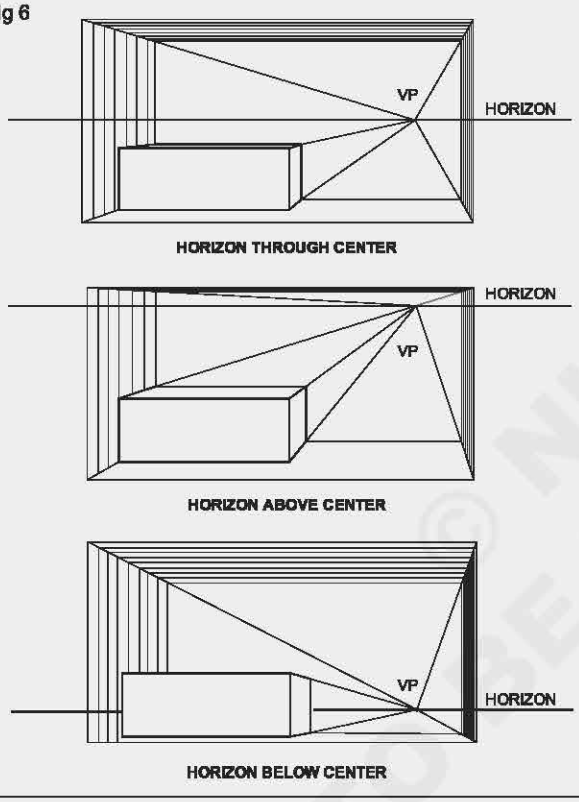


Fig 7

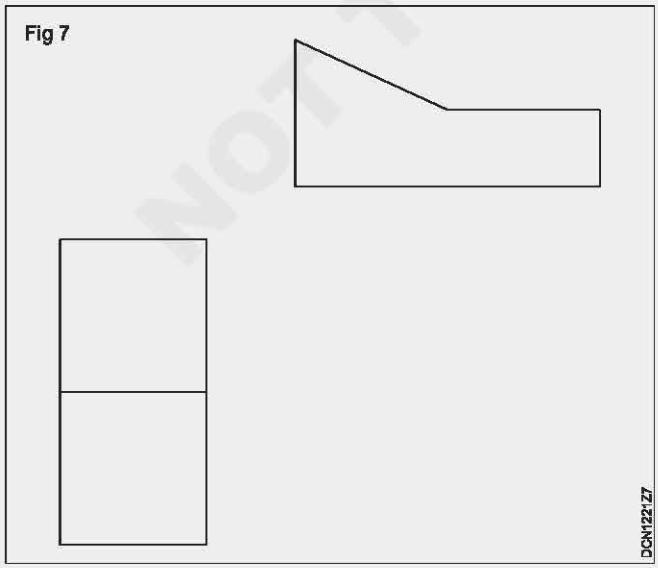
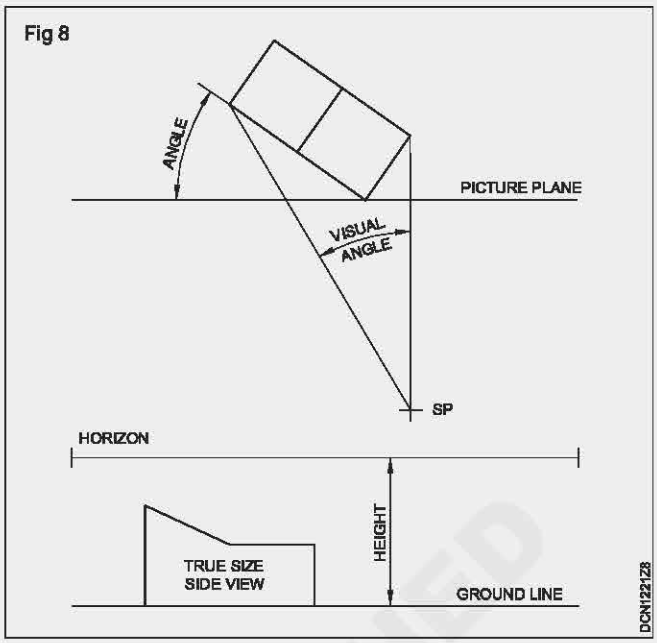


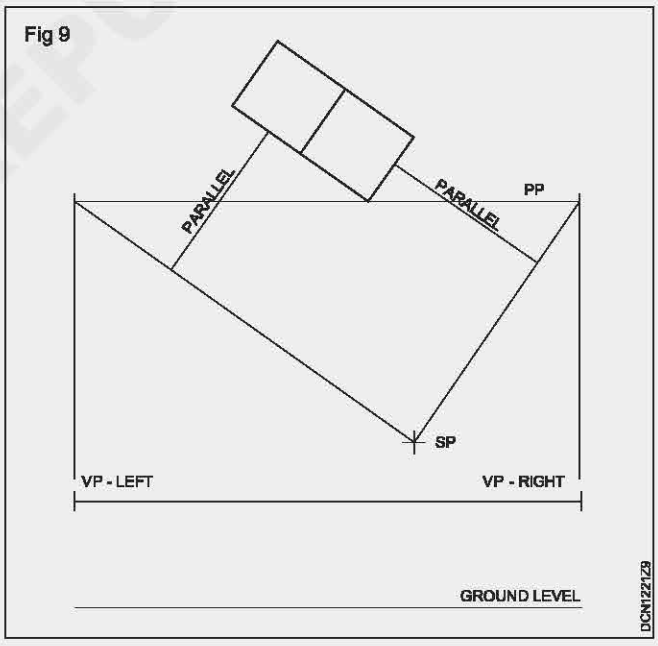
Fig 8



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.

- Mark the ground line and horizon.
- 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.

Fig 9



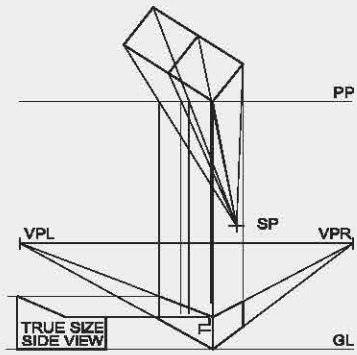
- Join the station points to all the corners of the top view. (Fig 10)
- The points at which they cross the picture plane are projected, perpendicular to the horizon.
- Project the corner to the ground line.

(It is the true length because it touches the picture plane)

- Draw the vanishing lines from it to each vanishing point.
- True height can be projected from the side.
- Draw the visual rays to the corners of the top view.

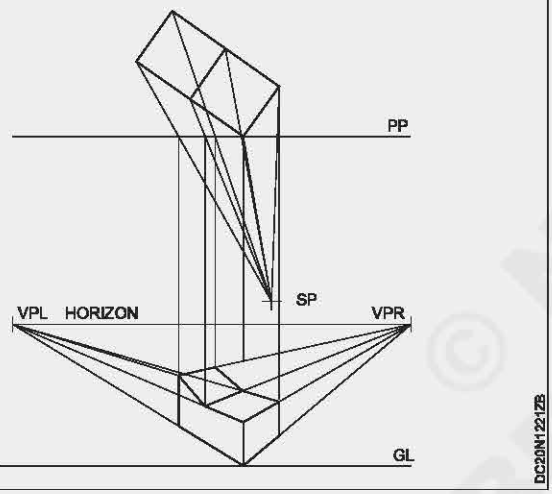
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Fig 10



- Project the points where they cross the picture plane to the pictorial view. (Fig 10)
- The points at which these projectors crossing the vanishing lines are the corners of the object.
- Project all the corners of the object to the pictorial view.
- Connect the corners to complete the perspective views. (Fig 11)

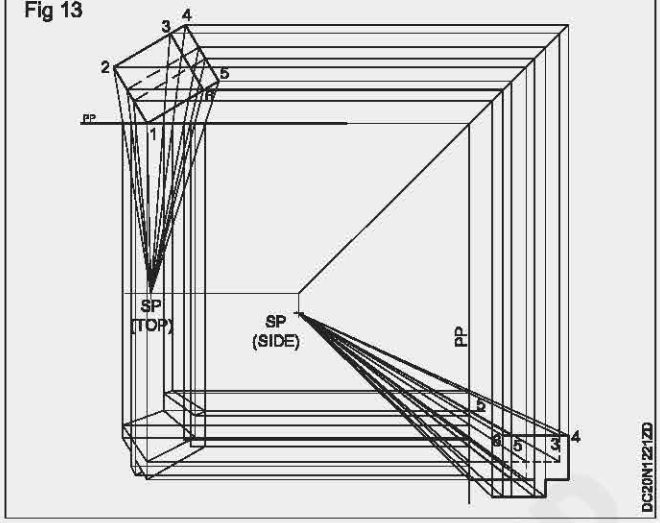
Fig 11



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

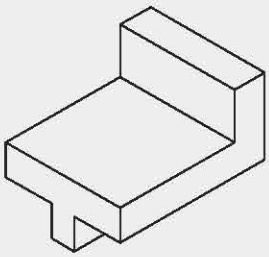
- Draw the top view as shown in Fig 10.
- Project the top view to form side view.

Fig 13



- Locate the picture plane and station point for each view.
- From each station point, draw visual rays to the object in that view.
- The point at which the rays pierce the picture plane project the perspective view.
- The point at which the projections of a point from the top and side views cross locates a point at the perspective.
- 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 12



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

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

PROCEDURE

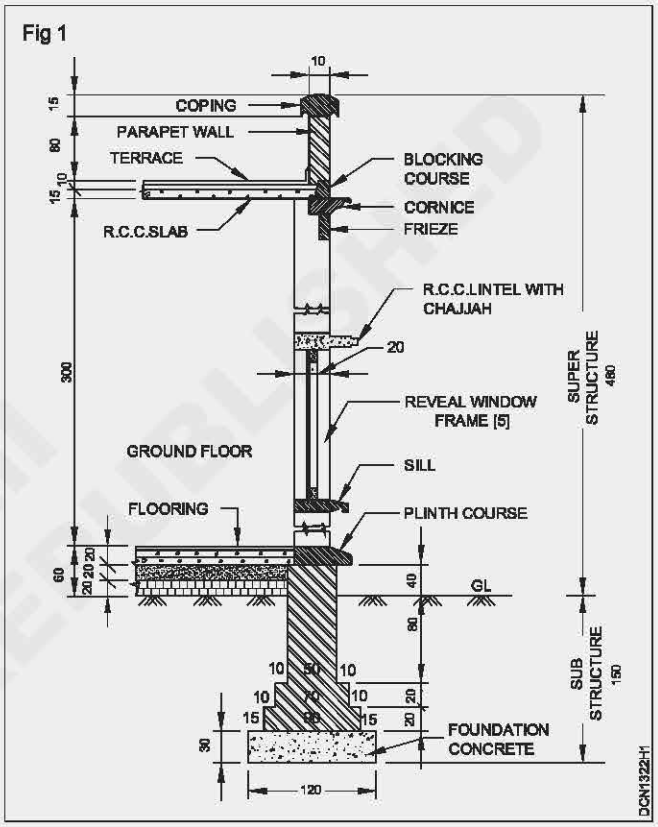
With given detailed dimension of the parts of the building. Develop the sub-structure plinth, flooring, sill, window, R.C. lintel with chajjah string coarse, roof, parapet wall and coping.

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
- Wall thickness = 20 cm

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

Fig 1



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Stone masonry and stone joint

Objectives : At the end of this exercise you shall be able to
- **sketch the coursed random rubble masonry**
- **sketch the uncoursed random rubble masonry**
- **sketch the coursed square rubble masonry**
- **sketch the uncoursed square rubble masonry**
- **sketch the polygonal rubble masonry**
- **sketch the flint rubble masonry**
- **sketch the dry rubble masonry.**

PROCEDURE

TASK 1: **Draw the plan elevation section of coursed random rubble masonry**

Data: The height of each course = 150 mm to 300mm.

- Draw each course in free hand and complete the drawing as per given sketch. (Fig 1)

TASK 2 : **Draw the elevation section of uncoursed random rubble masonry**

Data: Maximum stone should not exceed 300mm

- Draw the uncoursed rubble masonry as per given drawing. (Fig 2)

TASK 3 : **Draw the plan, elevation, section of coursed square rubble masonry (Fig 3)**

TASK 4 : **Draw the plan, elevation section of uncoursed squared rubble masonry (Fig 4)**

TASK 5 : **Draw the elevation of polygonal rubble masonry**

Data: The height of stone between 150 mm to 300mm.

- Draw the masonry in free hand and complete the elevation as shown in figure. (Fig 5)

TASK 6 : **Draw the elevation of flint rubble masonry**

- Draw lacing courses as shown in figure (atleast 3 course)
- Sketch the cousrse with flint stone over the lacing courses.
- Draw the remaining height of wall with lacing courses and flint courses alternatively
- Complete the drawing. (Fig 6)

TASK 7 : **Draw the elevation of dry rubble masonry as shown in Fig 7**

Data: Maximum stone should not exceed 300 mm.

Fig 1

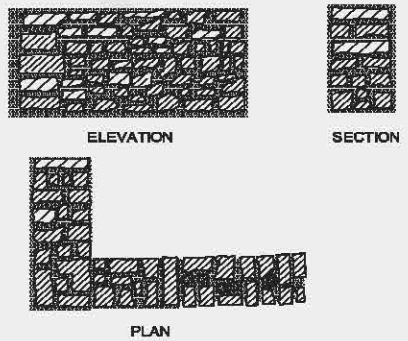
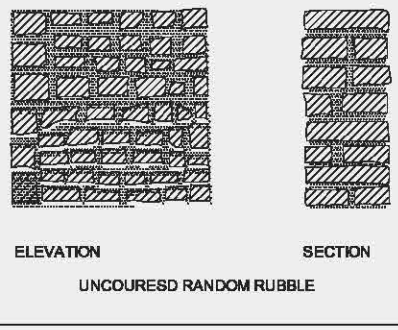
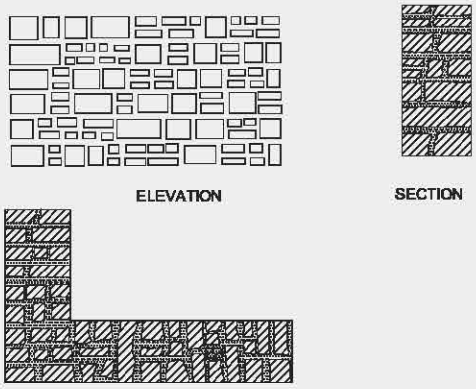


Fig 2



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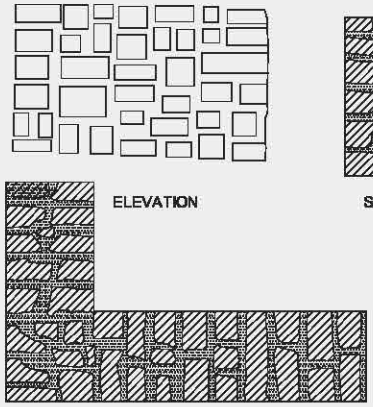
Fig 3



COURSED SQUARE RUBBLE MASONRY

DCN1323H3

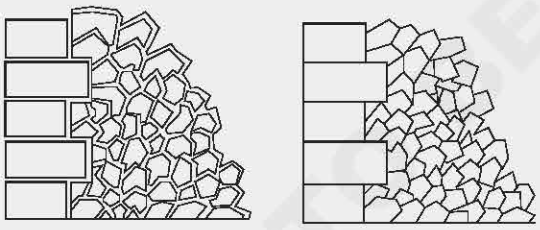
Fig 4



UNCOURSED SQUARED RUBBLE

DCN1323H4

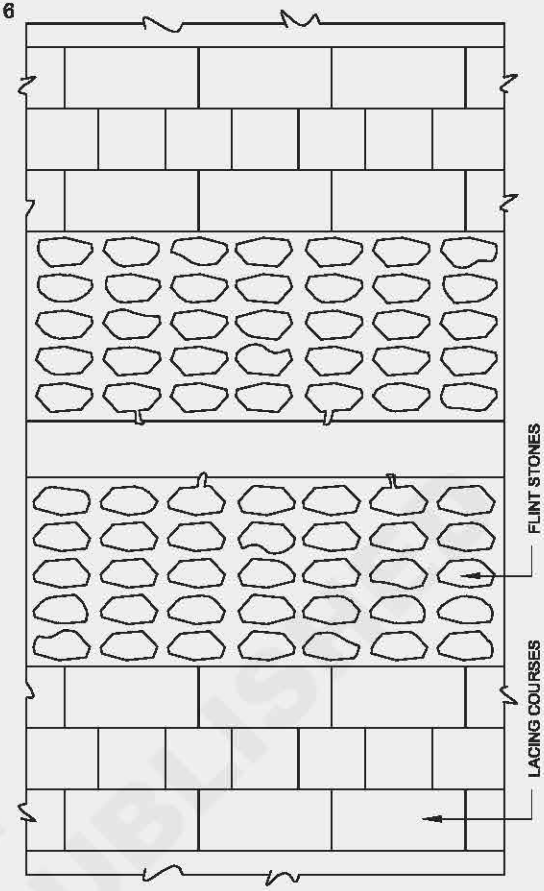
Fig 5



POLYGON RUBBLE MASONRY

DCN1323H5

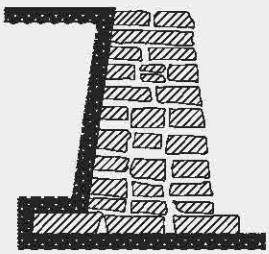
Fig 6



ELEVATION OF FLINT RUBBLE MASONRY

DCN1323H6

Fig 7



DRY RUBBLE MASONRY

DCN1323H7

Stone masonry - Types of ashlar masonry

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

- **draw the ashlar fine masonry**
- **draw the ashlar rough tooled masonry**
- **draw the ashlar chamfered masonry**
- **draw the quarry faced masonry**
- **differentiate various ashlar masonry.**

TASK 1: **Draw the elevation of ashlar fine masonry (6 courses) (Fig 1)**

Data : Height of each course : 300 mm

- Draw the arrangements of each course to avoid continuous vertical joint.
- Complete the drawing as per given drawing.

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TASK 2: **Draw the elevation of ashlar rough tooled masonry (Fig 2)**

- Draw the figure as per given sketch height of each course is 300 mm
- Draw the arrangements each course to avoid continuous vertical joint.
- Show the mortar thickness (6mm)between stones
- Hatch the stone for rough tooled finish
- Complete the drawing

TASK 3 **: Draw the elevaion of ashlar chamfered masonry (Fig 3)**

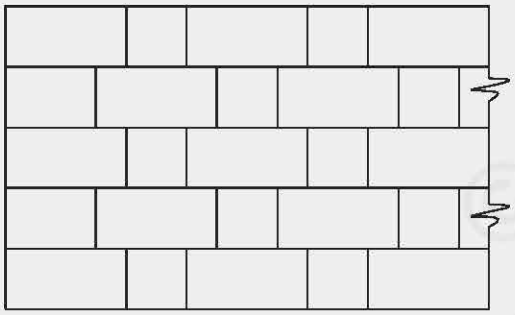
- Draw the elevation as shown, height of each course 200mm
- Arrange each course to avoid continuous vertical joints.
- Draw lines to show the 45^0 chamfering around each stllone.
- Complete the drawing.

TASK 4: **Draw the elevation of ashlar quarry faced masonry (Fig 4)**

- Draw each course as shown height of each course 200mm
- Draw the arrangments of the stone by avoiding continuous vertical joints
- Show the quarry faced symbol as shown
- Complete the drawing

Choose suitable scale

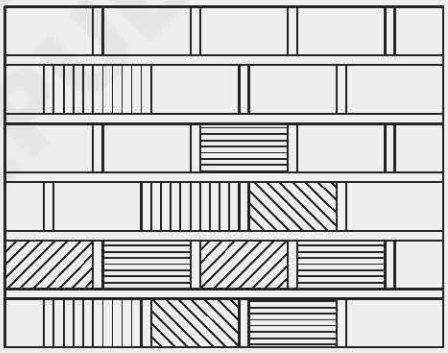
Fig 1



ASHLAR FINE MASONRY

DCN1323.J1

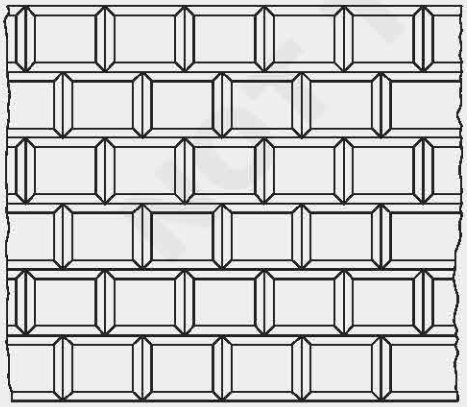
Fig 2



ASHLAR ROUGH TOOLED

DCN1323.J2

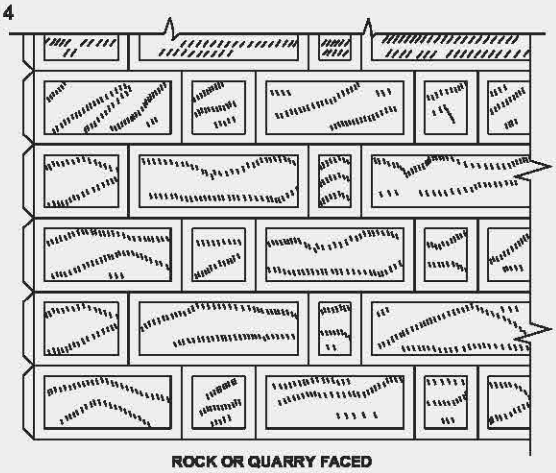
Fig 3



ASHLAR CHAMFERED

DCN1323.J3

Fig 4



ROCK OR QUARRY FACED

DCN1323.J4

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Types of - Stone joints

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

- **draw the butt joint**
- **draw the rebated (or) lapped joint**
- **draw the tongued and grooved joint (or) joggle joint**
- **draw the tabled joint**
- **draw the dowelled joint**
- **draw the cramped joint**
- **draw the plugged joint**
- **draw the rusticated joint**
- **draw the saddled joint**
- **draw the slate joint.**

TASK 1: **Draw the butt joint shown in Fig 1**

Data : Thickness of stone = 30 cm

TASK 2: **Draw the rebated joint shown in Fig 2**

Data : The part that laps over should not be less than 7.60 cm.

TASK 3: **Draw the tongued and grooved joint shown in Fig 3.**

Data : Stone height = 30 cm

- One third of groove thickness in stone height
- Groove projection = 7.60 cm

TASK 4: **Draw the tabled joint shown in Fig 4**

Data : Stone height = 30 cm

- The depth of projection = 40 mm
- The width one third the breadth of the stone
- Height of stone = 300 mm
- Length of stone = 600 mm

TASK 5: **Draw the dowelled joint shown in Fig 5**

Data :

- Stone size = 600 x 450 x 300 mm
- Dowe size = 150 x 50 x 50 mm

TASK 6: **Draw the cramped joint shown in Fig 6**

Data :

- Height of stone = 300 mm
- Width of metal cramp = 50 mm
- Thickness of metal cramp = 15 mm
- Length of metal cramp = 500 mm
- Long with ends which are turned down is 40 mm

TASK 7: **Draw the plugged joint shown in Fig 7**

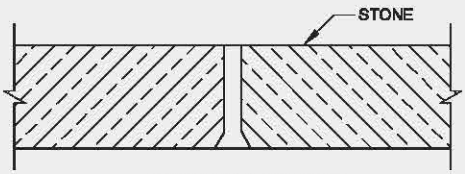
TASK 8: **Draw the rusticated joint shown in Fig 8**

TASK 9: **Draw the saddled joint shown in Fig 9**

TASK 10: **Draw the slate joint shown in Fig 10**

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Fig 1



BUTT OR SQUARE JOINT

DC20N1323X1

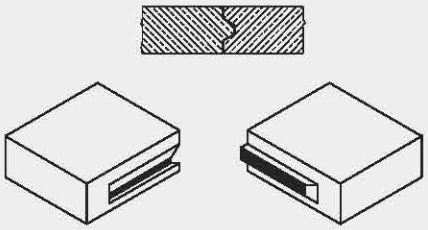
Fig 2



REBATED JOINT OR LAP JOINT

DCN1323X2

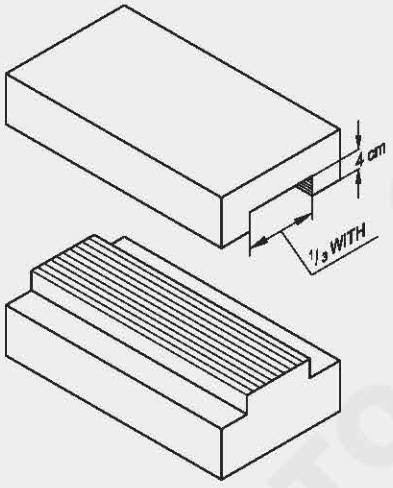
Fig 3



TONGUED AND GROOVED JOINT

DCN1323X3

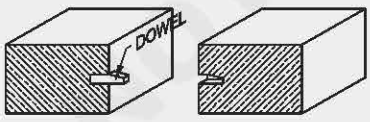
Fig 4



TABLED JOINT

DC20N1323X4

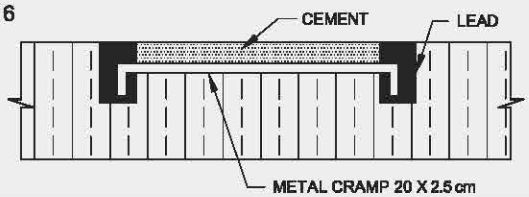
Fig 5



DOWELLED JOINT

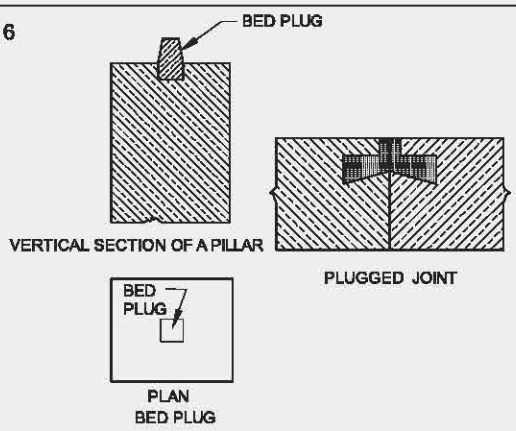
DC20N1323X5

Fig 6



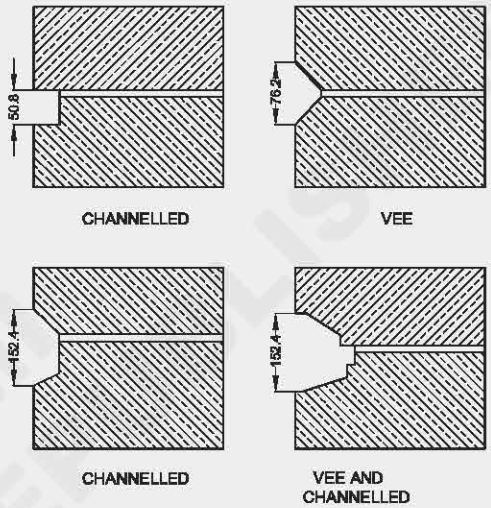
DC20N1323X6

Fig 6



DC20N1323X6

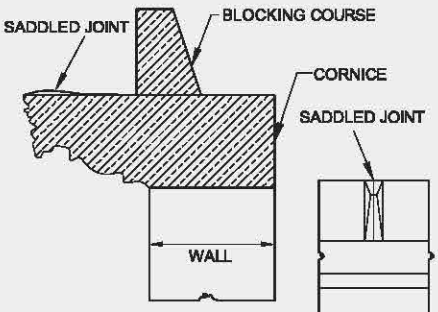
Fig 8



RUSTICATED JOINT

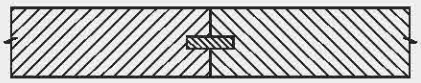
DC20N1323X8

Fig 9



DC20N1323X9

Fig 10



SLATE JOINT

DC20N1323XA

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Different types of brick bonding (Pillars,Coping etc)

Objectives : At the end of this exercise you shall be able to
- **draw the plan of one and one & half thick wall in english bond**
- **draw the elevation of wall in english bond**
- **draw the isometric view of wall in english bond.**

PROCEDURE

- **Draw plan & elevation of one brick thick wall in english bond.**

Data :

Size of brick = 200 mm x 100 mm x 100 mm

Size of queen closer = 200 mm x 50 mm x 100 mm

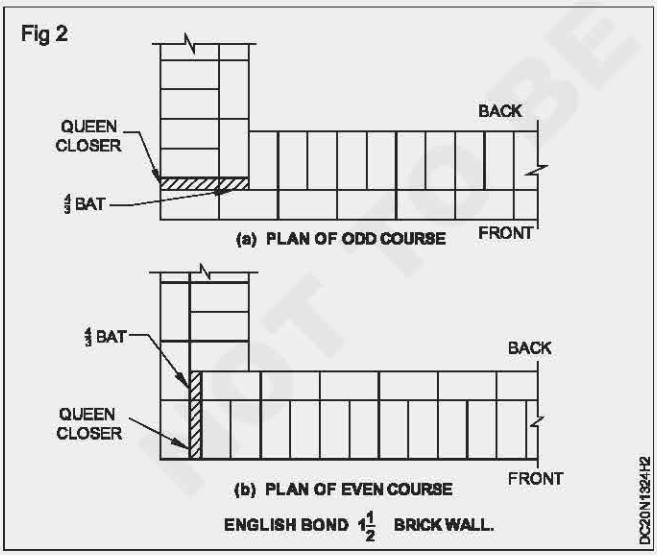
Height of each course = 100 mm

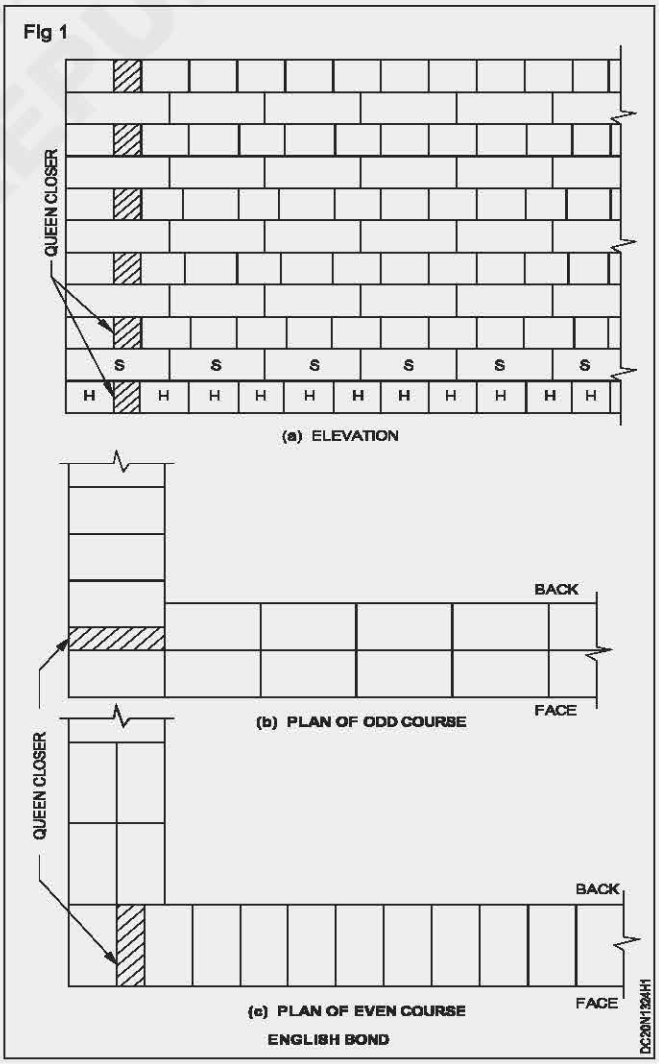
TASK 1: **To draw a plan of odd and even course (Fig 1a,b)**

- Draw the odd course of wall thickness 200mm and 1000mm length in both direction. Arrange the bricks in headers in one direction and stretchers in the other. Use queen closer after the quoins header.
- Draw the even course by arranging bricks as stretchers above headers in odd course and vice versa.
- Draw projectors from the odd and even course and develope the elevations (Fig 1c)

TASK 2: **To draw plan of odd and even course one and half thick wall in english bond (Fig 2)**

- Draw the odd course and even course of wall thickness 300mm (1 1/2 thick)and brick length about 1000mm on both direction.
- Arrange the bricks as shown in (Fig 2)
- Develop the isometric view of the wall with at least 5 layers.

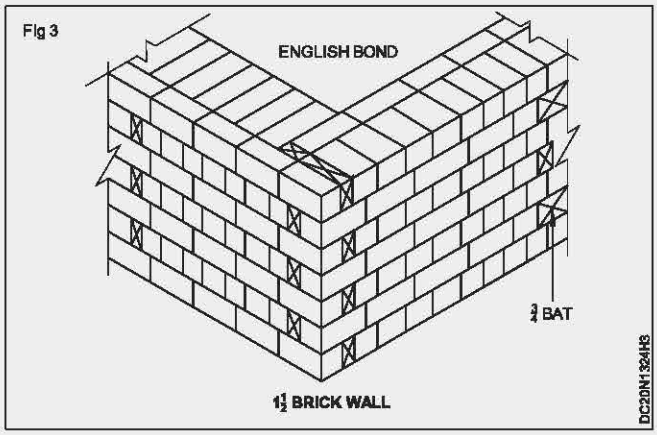




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TASK 3: **To draw elevation (Fig 3)**

- Draw the projection lines from plans of odd and even courses and complete the elevation as shown in figure.



Corner walls in Flemish bond

Objectives : At the end of this exercise you shall be able to
- **draw the plan and elevation of one brick**
- **draw plan and elevation of one and half brick wall in double flemish bond**
- **draw the plan of one & half and two brick wall in single flemish bond**
- **draw the isometric view of wall in double flemish bond.**

TASK 1: **Draw plan & elevation of one brick wall in double flemish bond**

- **To draw odd course, even course and elevation**
  - Draw 200mm thick corner walls
  - Draw quoin heades & queen closer.
  - Draw headers and stretchers alternately in both direction and complete the course
- Draw the even course as mentioned above in such a way that to avoid continuous vertical joint (Fig 1a).
- Draw projections from odd and even courses and develop the elevation (Fig 1).

TASK 2: **Draw plan and elevation of one & half brick wall in double flemish bond (Fig 2,2a,2b)**

- Draw 30mm thick corner wall .
- Arrange the bricks as shown in figure

TASK 3: **Draw the isometric view of wall in double flemish bond**

- Draw the isometric views of the corners of the above walls given in Task 1 and Task 2.

TASK 4: **Draw plan of one and half brick thick wall in single flemish bond (Fig 1&2)**

- Draw the corner wall with 300mm thick
- Arrange the bricks in such a way that facing is flemish bond if hearting and backing in english bond.
- Provide queen closer next to quoin header.
- Provide half bats or queen closer where ever neces sary to avoid continuous vertical joints.
- Complete the drawing.

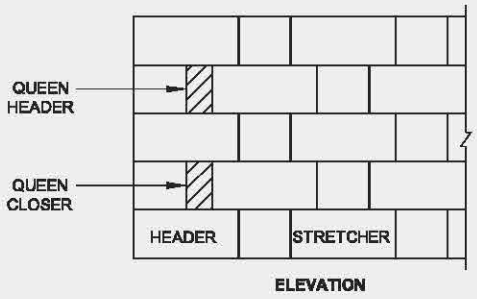
TASK 5 : **Draw plan of two brick wall in single flemish bond**

To draw odd and even course

- Draw the corner wall with 400mm thicks.
- Arrange the bricks as the same manners as the above task.
- Complete the drawing as shown in the (Fig 3).

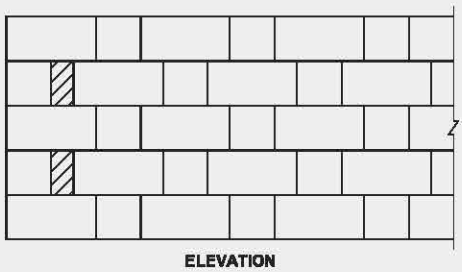
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Fig 1

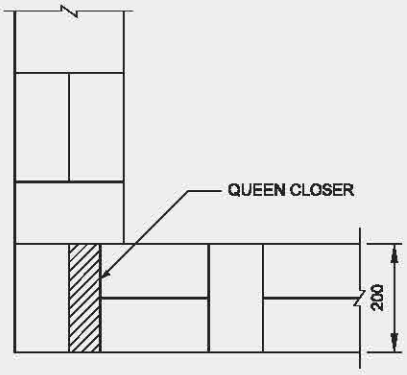


ELEVATION

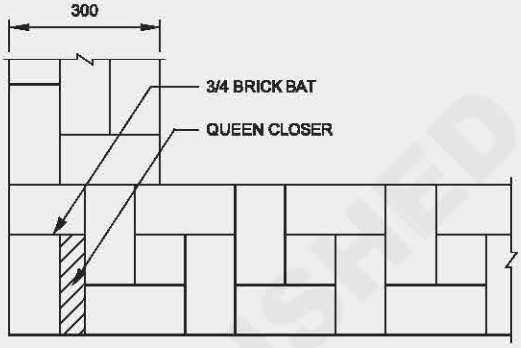
Fig 2



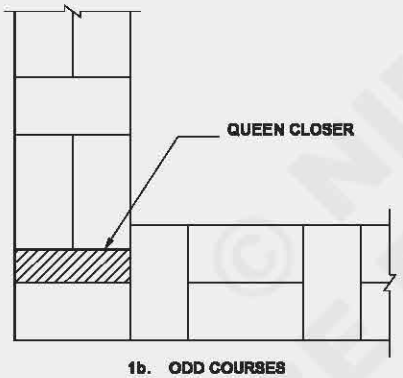
ELEVATION



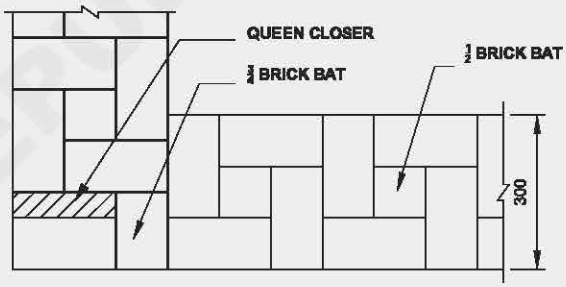
1a. EVEN COURSE



2a. EVEN COURSE



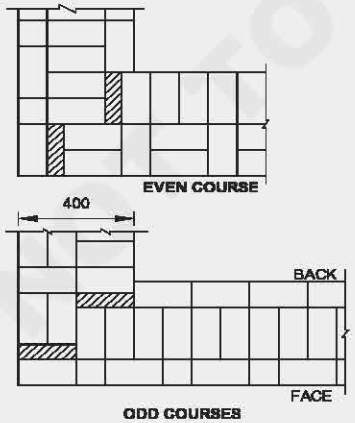
1b. ODD COURSES



2b. ODD COURSES

DC20N1324J1

Fig 3



ODD COURSES

DC20N1324J3

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Other types of bonds in walls

Objectives : At the end of this exercise you shall be able to
- **draw plan, elevation, and isometric view for header bond**
- **draw plan, elevation, and isometric views for stretcher bond**
- **draw elevation english garden wall bond**
- **draw elevation, and flemish garden wall bond**
- **draw plan for diagonal bond**
- **draw plan for herring bone bond.**

TASK 1: **Draw the wall in header bond**

To draw odd course

- Draw corner wall 200mm thick(Fig 1a)
- Provide 2nos of 3/4 bat as quoin headers
- Draw the arrangement of the bricks as header in both direction (Fig 1b)
- Draw projections lines from odd and even courses and develop the elevation(Fig 1c).
- Draw the isometric view and complete the drawing (Fig 1d).

TASK 2: **Draw the wall in stretcher bond**

- Draw corner wall of 100mm (Fig 2)
- Draw the arrangement the bricks as stretchers as in (Fig 2 a&b)
- Develop the elevation and isometric view (Fig 2cd) .

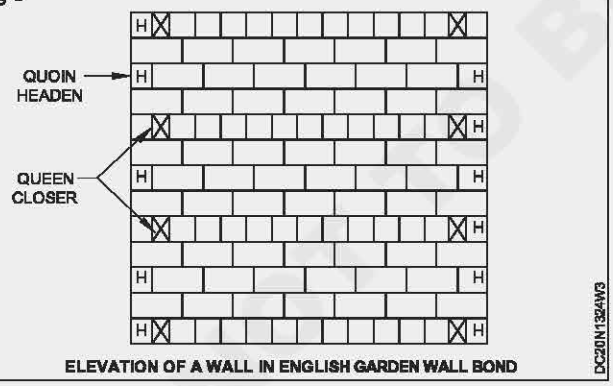
TASK 3: **Draw the elevation of wall in english garden wall bond**

- Draw the first course as header(Fig 3)
- Draw subsequent 3 or 5 courses as stretcher
- Then draw the next course as header course
- Repeat the pattern to complete the height

TASK 4: **Draw the elevation of walls in flemish garden wall bond**

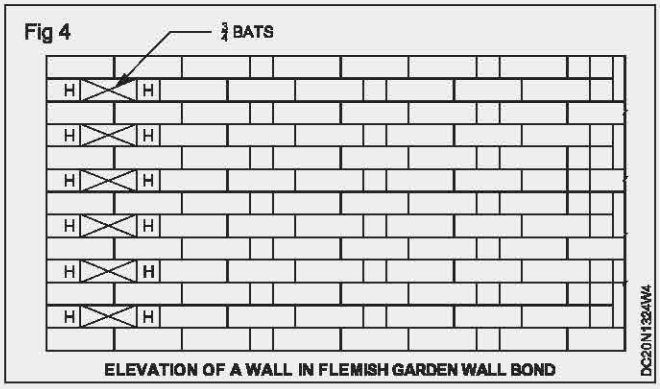
- Draw the arrangment of every course with one header after every 3 or 5 stretechers.(Fig 4)
- Provide a 3/4 bat after the quoin header
- Complete the drawing as shown in figure.

Fig 3



ELEVATION OF A WALL IN ENGLISH GARDEN WALL BOND

Fig 4

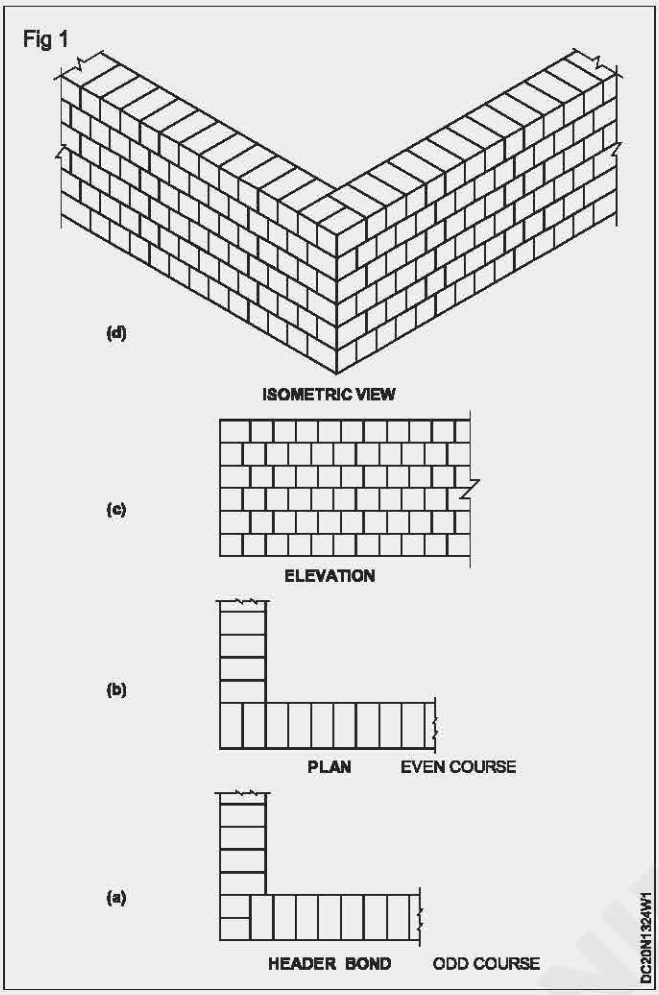


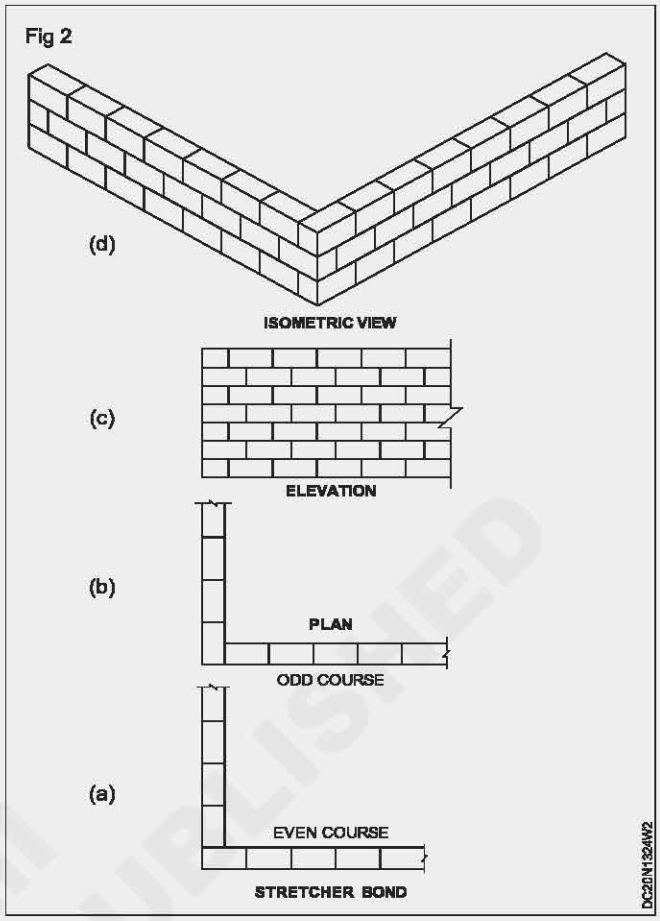
ELEVATION OF A WALL IN FLEMISH GARDEN WALL BOND

TASK 5: **Draw the plan of wall in diagonal bond (Fig 5)**

- Draw the outline of wall
- Draw the arrangements the bricks as stretchers in facing and backling
- Arrange bricks diagonally in hearting
- Use queen closer and pieces of bricks where ever necessary
- Complete the drawings.

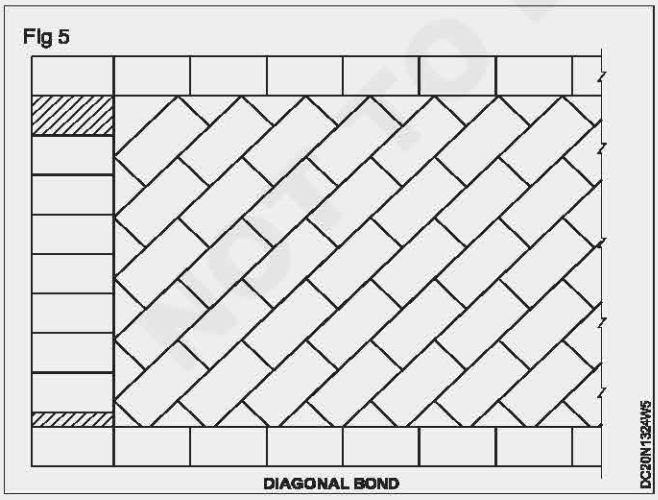
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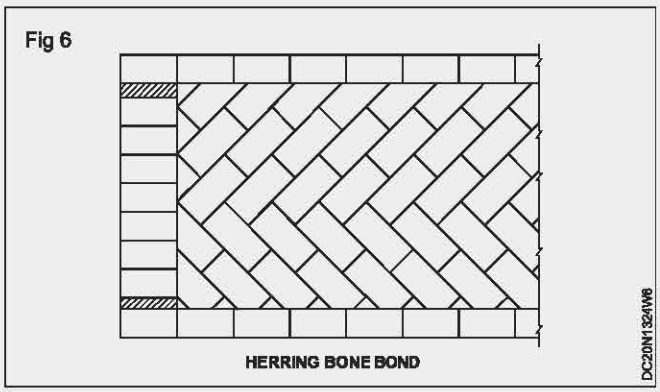




TASK 6: **Draw the plan of wall in herring bone bond**

- Draw the outlines of wall
- Arrange the bricks as stretchers in facing and backling
- Arrange the bricks 45° both ways from centre line of wall as shown in (Fig 6)
- Use queen closer and triangular pieces of brides wherever necessary as shown in figures
- Complete the drawing.





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Drawing of junctions and quoin walls

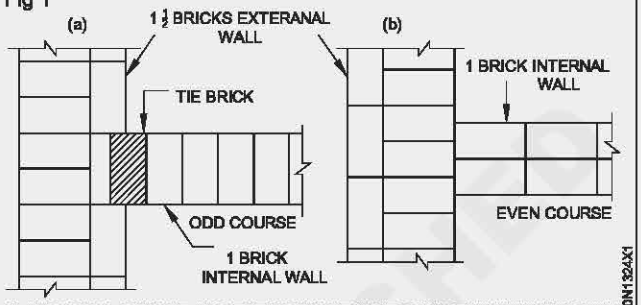
Objectives : At the end of this exercise you shall be able to
- **draw the plan of alternate courses of a tee junction wall in english bond**
- **draw the plan of alternate courses of a cross junction wall in english bond**
- **draw the plan of alternate courses of a squint junction wall in english bond**
- **draw the plan of alternate courses of a obtuse squint junction wall in english bond.**

DATA: Angle between External wall and internal wall = 90^0

TASK 1: **Draw the tee junction wall 300mm with 200mm in english bond**

- Draw the main wall 300mm thick and cross wall 200mm thick (Fig 1).
- Arrange the corners in english bond as shown in Fig ure (care should be taken that the header course of cross wall starts with a queen closes provided in main wall and tie brick is placed next to it. Stretchers course of cross wall)
- Complete the drawing

Fig 1

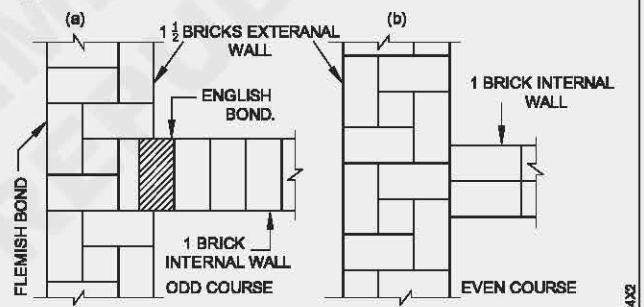


PLAN OF ODD COURSE AND EVEN COURSE IN TEE JUNCTION (ENGLISH BOND)

TASK 2: **Draw the tee junction wall 300mm with 200mm in english & flemish bonds**

- Draw the main wall 300mm thick and cross wall 200mm thick (Fig 2)
- Arrange the brick in flemish bond in main wall and english bond in cross wall
- Complete the drawing

Fig 2



PLAN OF ODD COURSE AND EVEN COURSE TEE JUNCTION (ENGLISH AND FLEMISH BOND)

TASK 3 : **Draw the plan of cross junction wall in english bond (300mm with 200mm)**

To draw odd course & even course

(Angle between two walls at the junction=90^0)

- Draw 300mm wall in English bond in vertically.
- Draw 200mm wall perpendicularly in English bond as shown in (Fig 3)

TASK 4: **Draw the plan of squint junction wall in english bond (300mm with 300mm)**

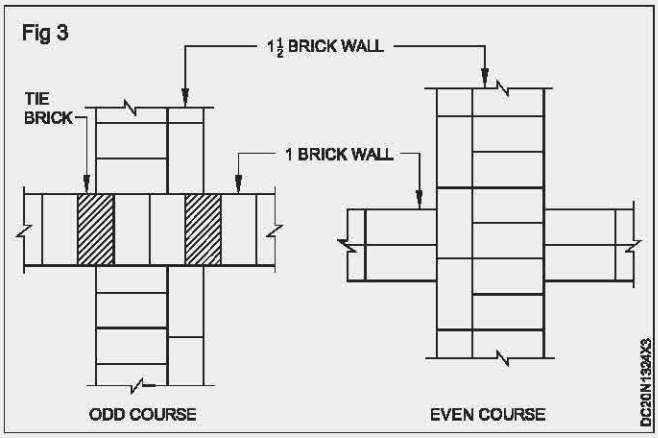
(Angle between the walls at the junction = 45^0)

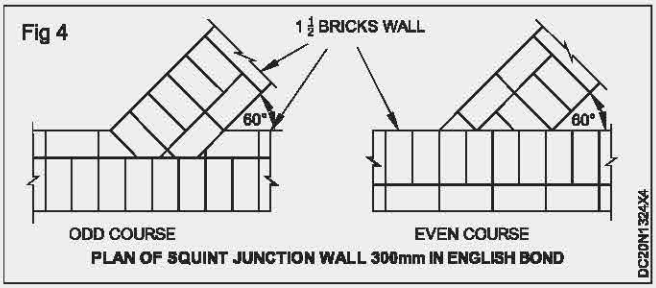
To draw odd course & even course (Fig 4)

- Draw 300mm thick main wall in English bond.
- Draw 300mm 45^0 inclined wall in the main wall as shown in figure.

3 Complete the drawing.

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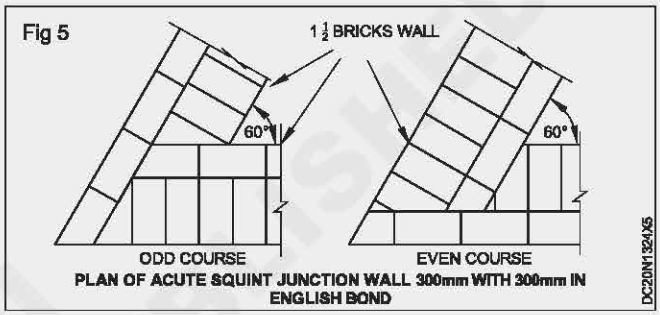




TASK 5: **Draw the plan of acute squint quoin wall in english bond (300mm with 300mm)**

(Angle between walls at the quoin ("External corner wall) = 60°

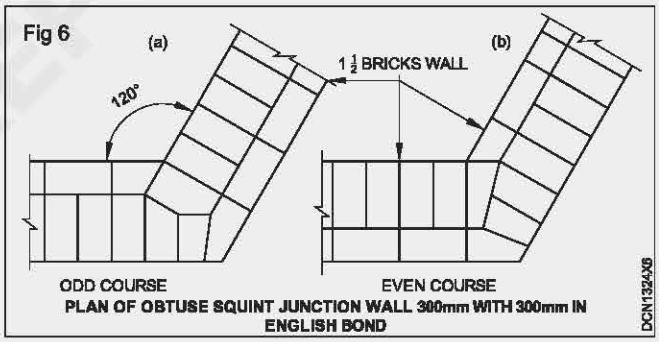
- Draw 300mm main wall in English bond.
- Draw 300mm 60^0 inclined wall in the main wall as shown in (Fig 5)



Task 6 : **Draw the plan of obtuse squint quoin wall in english bond (300mm with 300mm)**

(Angle between the wall at the quoins=120^0.)

- Draw 300mm main wall in English bond.
- Draw 300mm 120^0 inclined wall in the main wall.
- Complete the drawing as shown in (Fig 6).



Pillar and different composite masonry

Objectives : At the end of this exercise you shall be able to
- **draw the plan of pillars (both in english and flemish bond)**
- **draw the plan of attached pier**
- **draw the section of stone and brick composite masonry**
- **draw the section of brick and concrete composite masonry.**

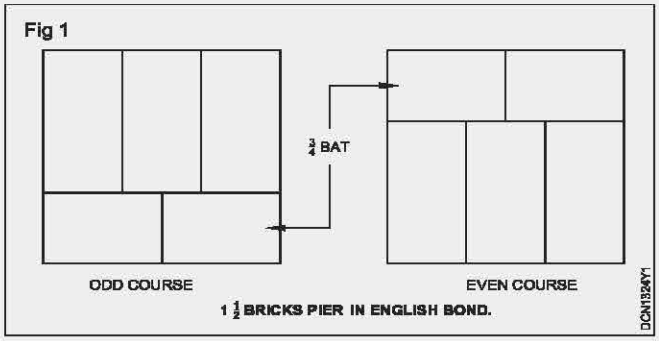
TASK 1: **Draw the plan of 1½ brick pier in english bond**

To draw odd course

- Draw 2 nos. ¾ brick bat and header face bricks near the 3/4 brick bat

To draw even course

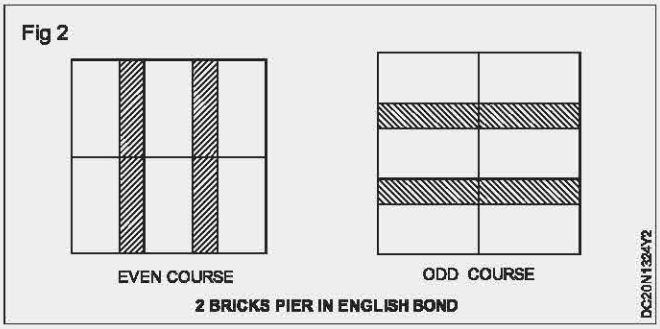
- Place the bricks as 3 headers at facing and 2 nos 3/4 bat at backing
- Complete the drawing (Fig 1)



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TASK 2: **Draw the plan of two brick pier in english bond**

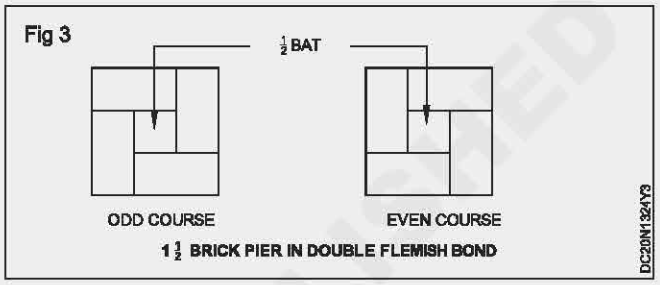
- Draw a square of side 400mm (Fig 2)
- Draw the arrangements of bricks in odd course and even course
- Complete the drawing



TASK 3: **Draw the plan of one and half brick pier in double flemish bond**

To draw odd course & even course

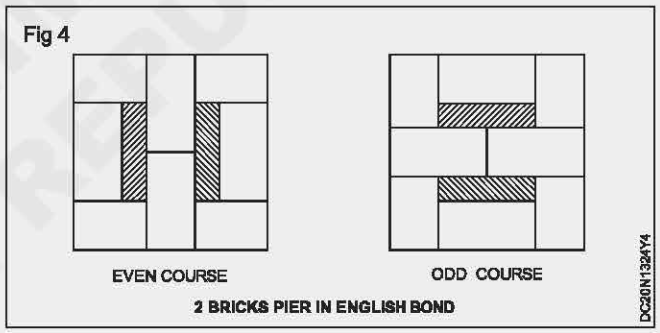
- Draw the arrangements of bricks in odd course and even course in flemish bond as in (Fig 3)



TASK 4: **Draw the plan of two brick pier in double flemish bond**

To draw odd course & even course

- Draw and arrange the bricks, queen closer, ¾ brick bat as shown in Fig 4)



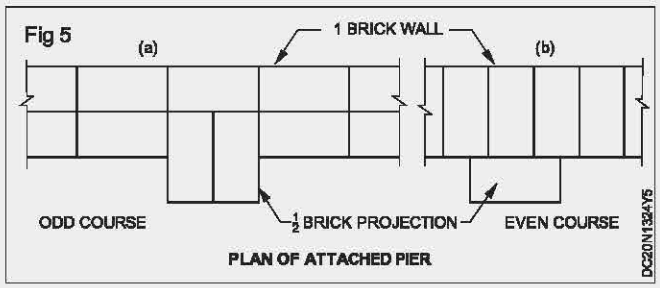
TASK 5: **Draw the plan of attached pier (1 brick thick)**

To draw odd course

- Draw 200 mm thick main walls as drawn in the previous exercise.
- Draw two of header face bricks as shown in (Fig 5a).

To draw even course

- Draw 200 mm thick main walls as drawn in the previous exercise.
- Draw one brick in stretcher face as shown in (Fig 5b).



TASK 6: **Draw the plan of two brick attached pier in english bond (Fig 6)**

Width of main wall = 300mm, width of pier = 400mm

To draw odd course

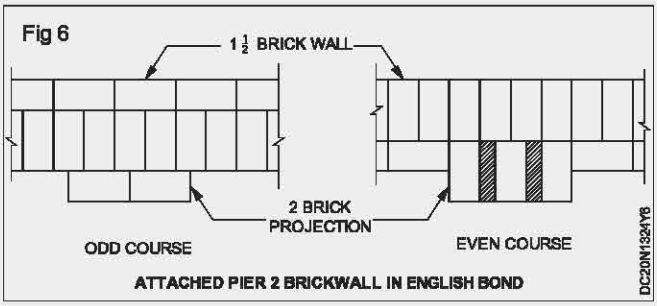
- Draw 300mm thick main walls as drawn in the previous exercise.
- Draw two brick in stretcher face as shown in figure.

To draw even course

- Draw 300mm thick main walls as drawn in the previous exercise.

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- Draw three bricks of header face and 2 queen closers shown in figure.



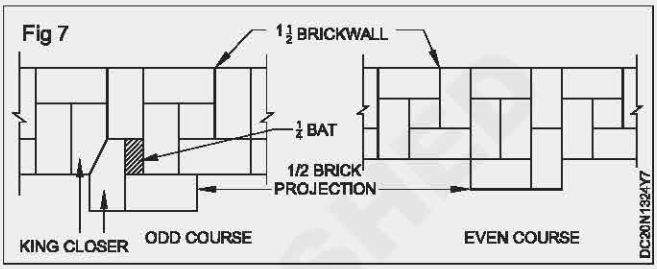
TASK 7: **Draw the plan of one and half brick pier in double flemish bond (Fig 7)**

Width of main wall = 300 mm

Width of pier 300 mm.

To draw odd course & to draw even course

- Draw the bricks as shown in figure.



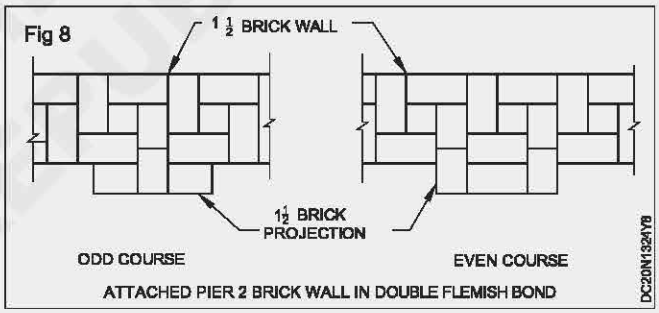
TASK 8 : **Draw the plan of two brick pier in double flemish bond (Fig 8)**

Width of main wall 300 mm

Width of pier 400mm

To draw odd course & to draw even course

- Draw the bricks as shown in figure



TASK 9 **: Draw the section of stone and brick composite masonry**

DATA : 300mm height stone 200 x 200 x 100 mm brick.

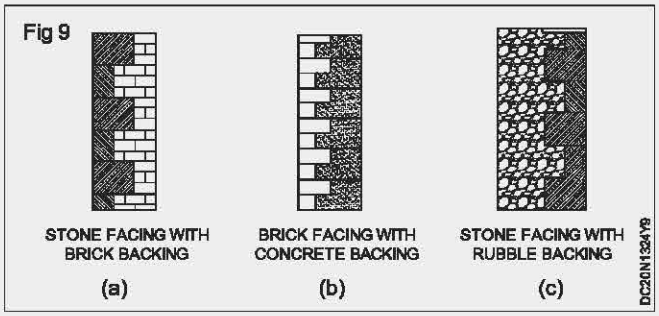
- Draw and arrange the stones and bricks as shown in (Fig 9a)

TASK 10 : **Draw the section of brick and concrete composite masonry**

- Draw and arrange the stone and concrete as shown in (Fig 9b).

TASK 11: **Draw the section of rubble and ashlar fine composite masonry**

- Draw and arrange the rubble and ashlar as shown in (Fig 9c).



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Types of brick coping and stone coping

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

- **draw the brick coping (ordinary coping, stone creasing coping, round coping-i, round coping - ii, saddle back coping, bullnose coping)**
- **draw the stone coping (Round coping with groove, saddle back coping, round coping, single chamfered coping, double chamfered coping, stone creasing coping).**

I Different types of brick coping (Figs 1a - 1f)

II Different types of stone copings (Figs 2a - 2f)

Fig 1

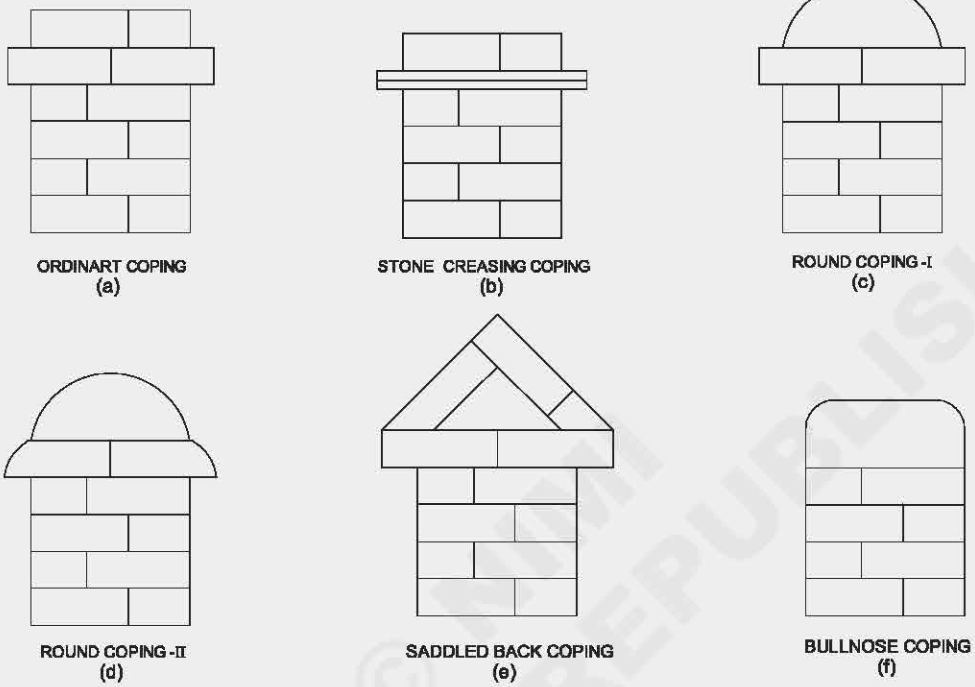
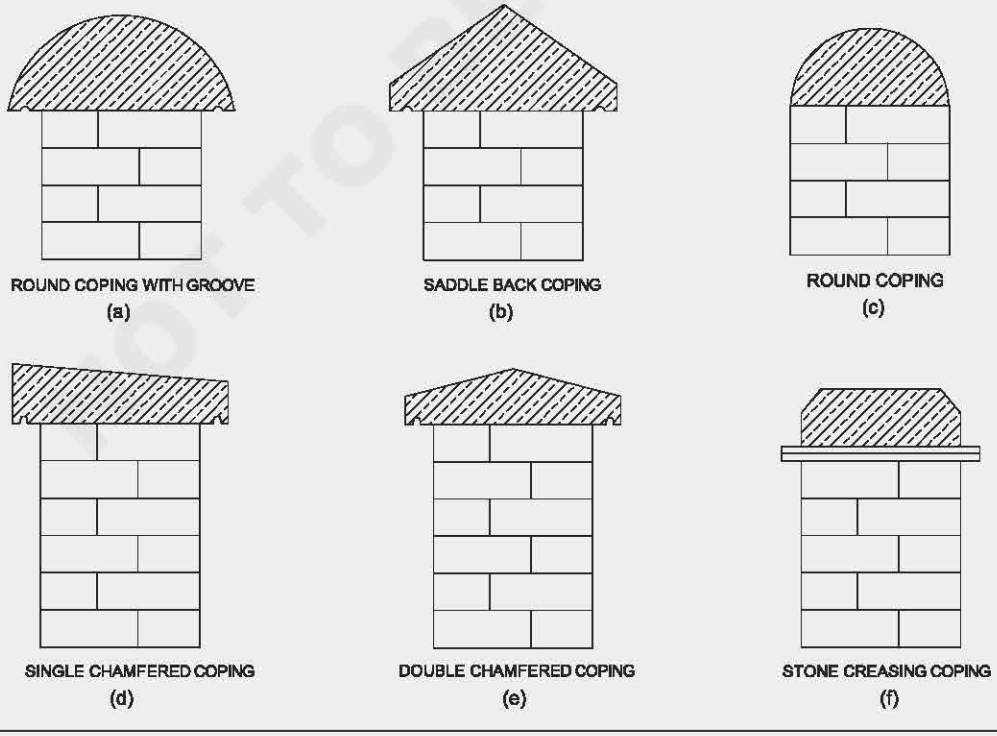


Fig 2



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Shallow foundation - Drawing of spread footing

Objectives: At the end of this exercise you shall be able to
- **draw footing for column**
- **draw footings for wall**
- **draw stepped foundation and inverted arch foundation.**

PROCEDURE

Data:

Brick pillar of size = 200 mmx200mm

Concrete footing size=600 mm x600 mm

Depth of concrete footing = 200 mm

TASK 1 : **Draw Single footing for column**

- Draw the plan of concrete footing size of 600 mmx 600mm (Fig 1)
- Draw the square for pillar at the centre size of 200 mm x 200 mm
- Hatch and complete the sectional plan
- Draw projectors for column and footing to develop the elevation
- Hatch and complete the sectional elevation

TASK 2 : **Draw Stepped footing for column (Fig 2)**

Data:

Size of pillar = 400 mmx400 mm

Size of concrete footing = 900 mm x 900 mm

Depth of concrete footing = 200 mm

Size of 1st brick footing = 600 mm x 600 mm

Size of 2nd brick footing = 500 mm x 500 mm

Depth of each footing = 200 mm

- First draw the outline of concrete footing size of 900 mm x 900mm(Fig 2a)
- Draw the outline for 1st brick footing size of 600 mmx600mm
- Draw the outline for 2nd brick footing size of 500 mmx500mm
- Draw the outline for the pillar size of 400 mm x 400 mm
- Complete the sectional plan
- Draw projectors for column and footings to develop the elevation (Fig 2b)
- Complete the sectional elevation

TASK 3 : **DrawSloped footing for R.C.C column (Fig 3)**

Data:

Size of column = 300 mm x 300 mm

Size of base concrete = 1800 mmx1800 mm

Depth of base concrete = 200 mm

Size of concrete footing = 1400 mmx1400 mm

Vertical height of concrete footing = 200 mm

Sloped height of concrete footing = 200 mm

Offset of concrete = 100 mm

- Draw the outline of base concrete size of 1800 mm x 1800 mm (Fig 3a)
- Draw the outline of concrete footing size of 1400mm x 1400 mm
- Draw the sectional plan of column 300mm X 300mm (Fig 3b)
- Draw the projectors of develop sectional elevation
- Complete the view

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TASK 4 : **Draw Rectangular combined footing for column (Fig 4)**

Data:

Size of exterior column - 500 mmx 500mm

Size of interior column - 600 mmx 600 mm

Centre to centre of columns - 5000 mm

Size of combined footing- 1600 mm x 6000 mm

Depth of combined footing - 200 mm

Offset of footing near exterior column- 250mm

Offset of footing near interior column- 200mm

- Draw outline for combined footing size of 1600 mmx 6000 mm (Fig 4a)
- Draw exterior column250 mm away from edges of footing
- Draw for Interior column 200mm away from edge of footing.
- Draw projectors to develop elevation and complete the view (Fig 4b).

TASK 5: **Draw Trapezoidal combined footing for column (Fig 5)**

Data:

Size of exterior column - 500 mm x 500 mm

Size of interior column - 600 mm x 600 mm

Centre to centre of columns -5000 mm

Breadth of concrete footing near exterior column-1000 mm

Breadth of concrete footing near interiorcolumn-2200 mm

Depth of footing-200 mm

Offset of footing near exterior column- 250mm

Offset of footing near interior column- 250 mm

- Draw the plan as per data (Fig 5a)
- Develop the elevation(Fig 5b)

TASK 6 : **Draw Cantilever footing for column (Fig 6)**

Data:

Size of exterior and interior column - 500 mmx500 mm

Centre to centre of column -5000 mm

Size of footing - 1000 mm x 1000 mm

Depth of footing-200 mm

Size of beam -500 mmx 200 mm

Offset of interior column-250 mm

- Draw the plan as per data-
- Develop the elevation
- Complete the drawings

TASK 7 :**Draw continuous footing for column (Fig 7)**

Data:

Size of column -300 mmx 300mm -9 nos

Spacing of column -300 mmx300 mm

Offset of concrete -250 mm

Size of base concrete -6800mm x 6800 mm x 600

Depth of concrete-600mm

- Draw the plan as per data
- Develop the elevation
- Complete the drawings.

TASK 8 : **Draw Simple footing for a wall (Fig 8)**

Data

Wall thickness -200mm

a-offset-150 mm

d - depth of concrete - 200 mm

Depth of footing below ground level-800 mm

B-breadth of footing-500 mm

- Draw the plan as per data
- Project the elevation
- Hatch and complete the drawing

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Fig 1

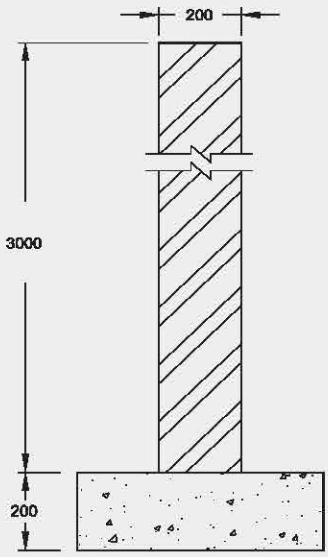


Fig 2

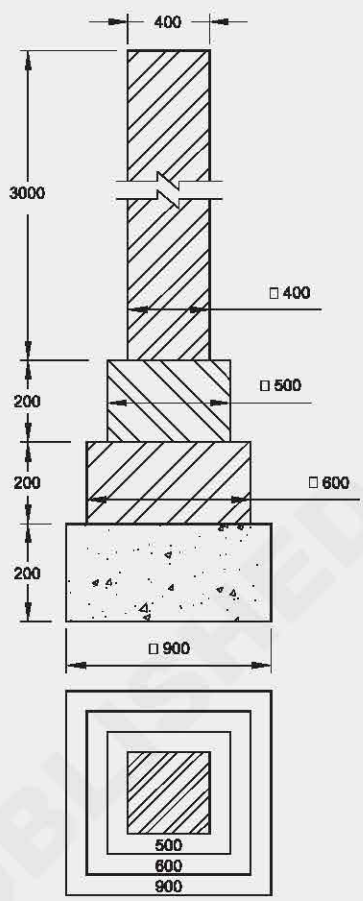


Fig 3

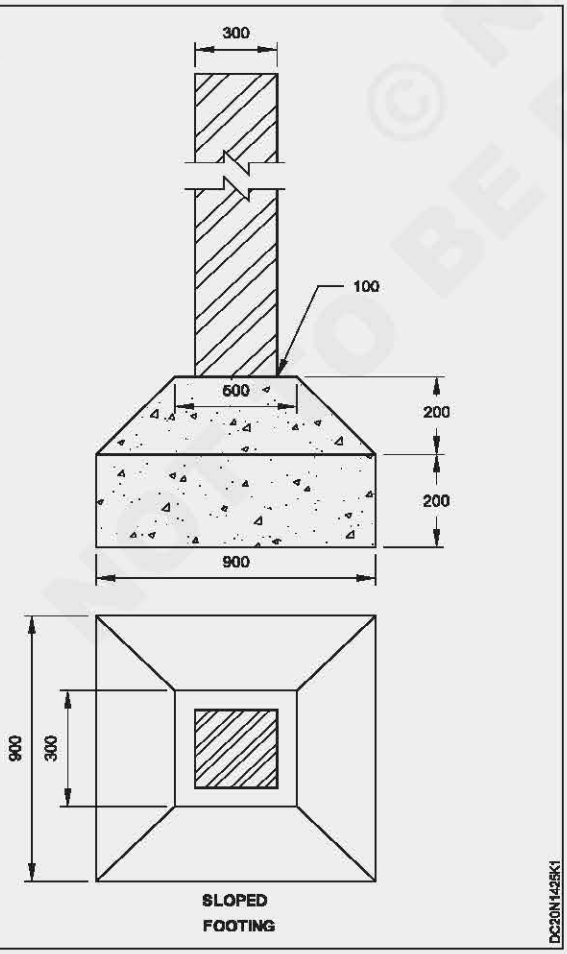
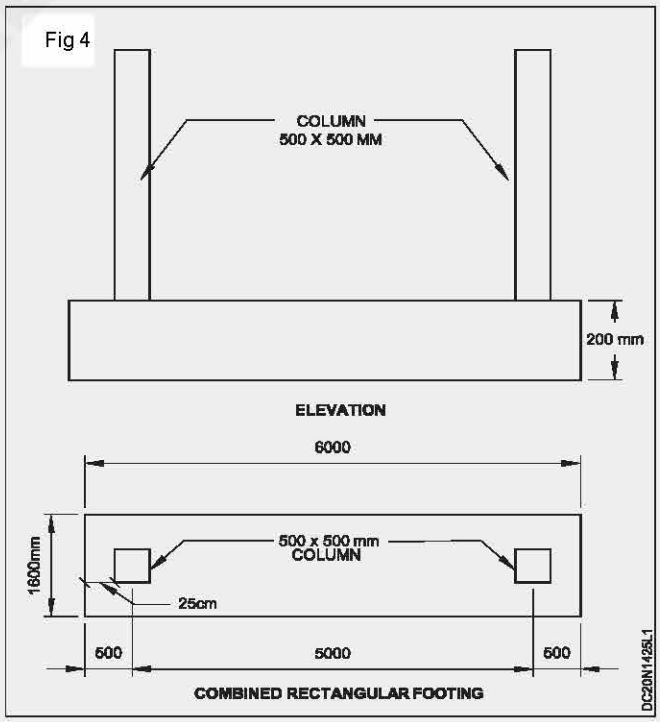


Fig 4



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Fig 5

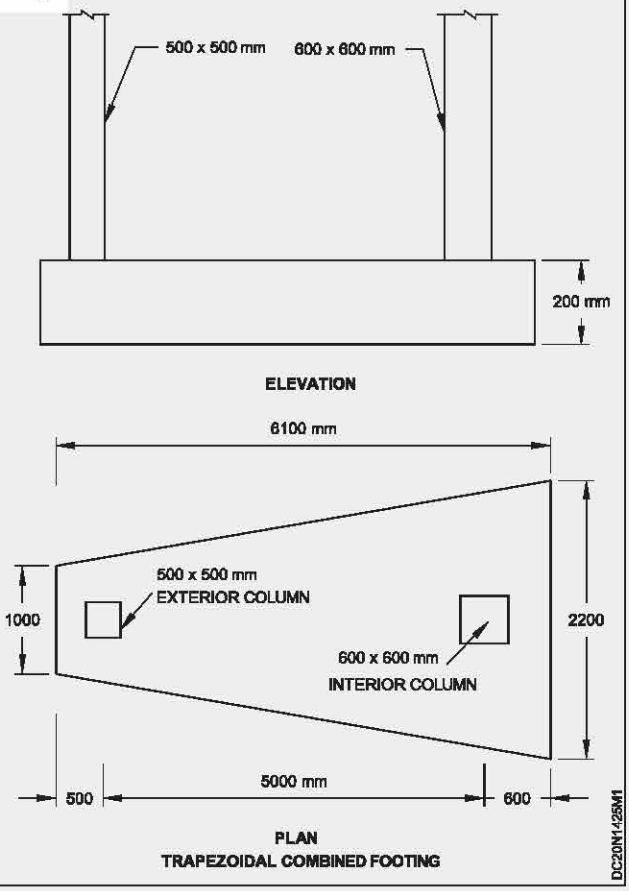


Fig 6

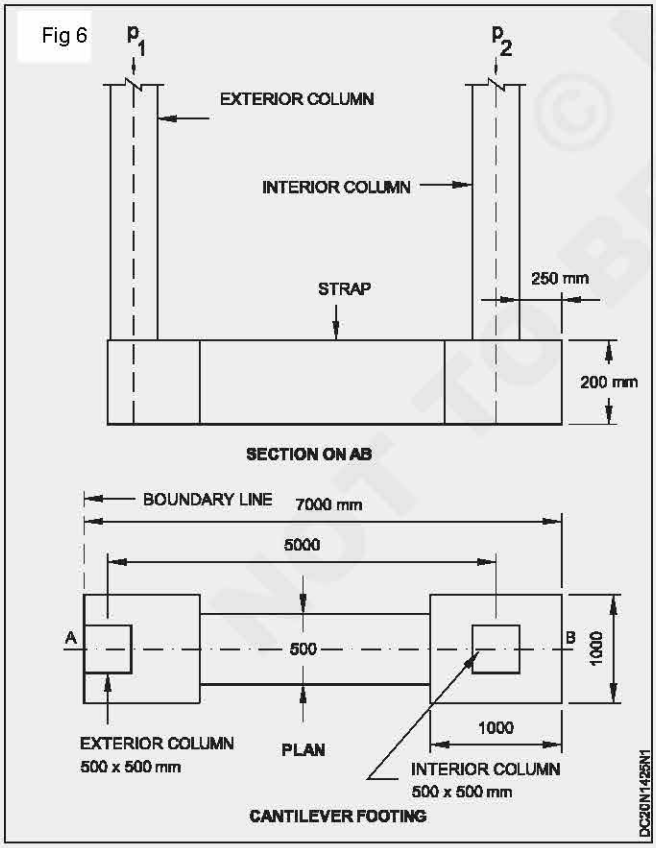


Fig 7

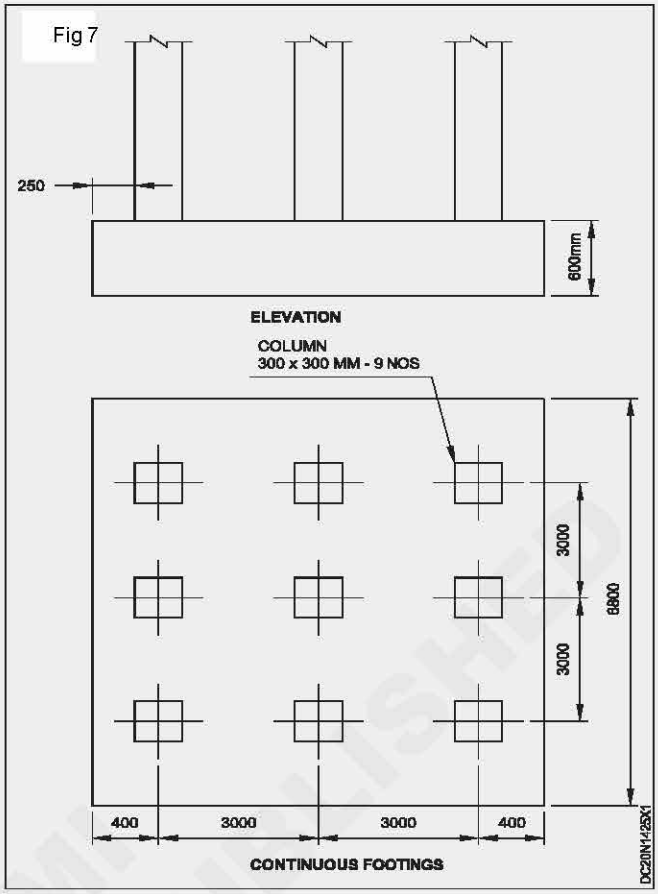
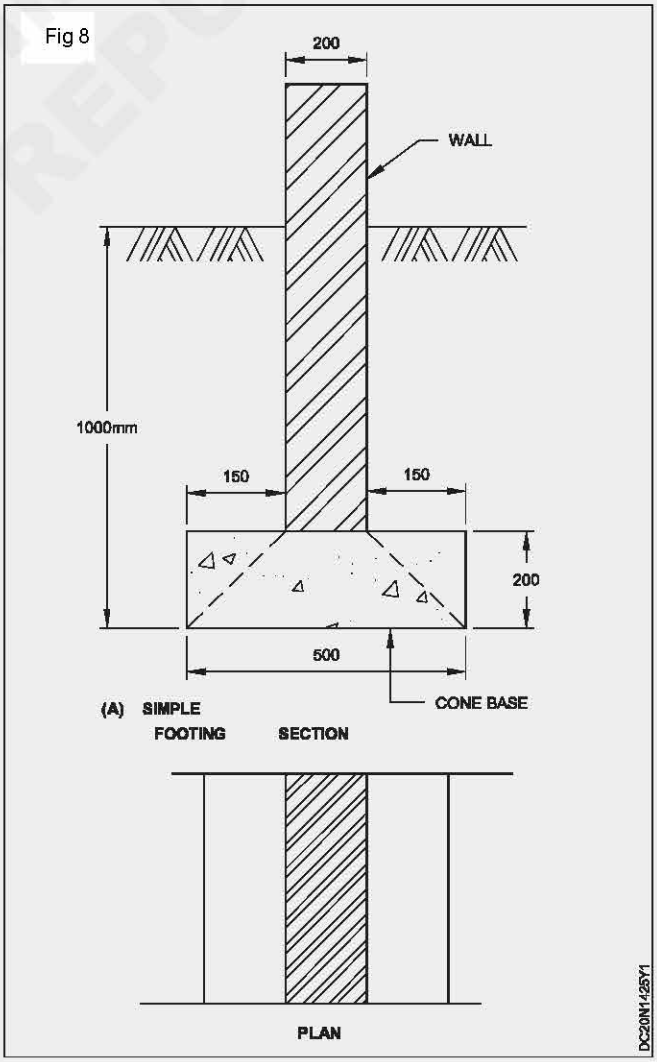


Fig 8



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TASK 9 **: Draw the sectional elevation of a Spread footing for wall (Fig 9)**

Data:

Wall thickness-300 mm

D- Depth of foundation from ground level-90 mm

a - offset of concrete -150 mm

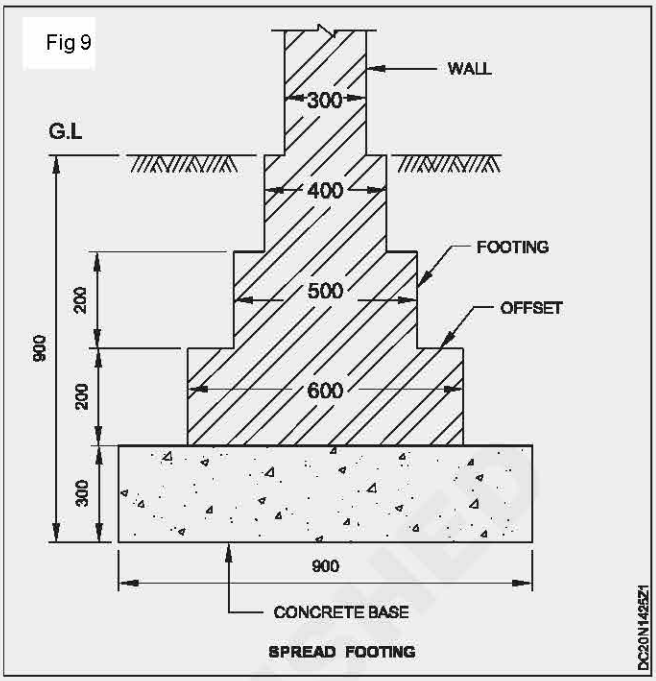
Offset of brickwork- 50 mm

Thickness of footing-200 mm

d-Depth of concrete base -300 mm

B-Breadth of concrete base-900 mm

Fig 9



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Shallow foundation - Drawing of grillage foundation

Objective: At the end of this exercise you shall be able to
- **develop the top view and draw cross section of grillage foundation.**

PROCEDURE

Data : First layer of RSJ

No.of R.S.J in lower tier (layer)-10 nos

C.S size of R.S.ISMB (150 X 80 X 4.8)

Dia of bolt -32 mm

No of bolt - 3

Second layer of RSJ

No of RSJ in the upper layer- 3 nos.

C.S size of RSJ - ISMB (250 X 125 X 6.9)

Bolt details similar to 1 st layer

Steel Stanchion

RSJ column - ISWB 300 (300 X 200 X 74mm)

Angle shoe size I SA200 X 200 X 12

Thickness of gusset plate -10 mm thick

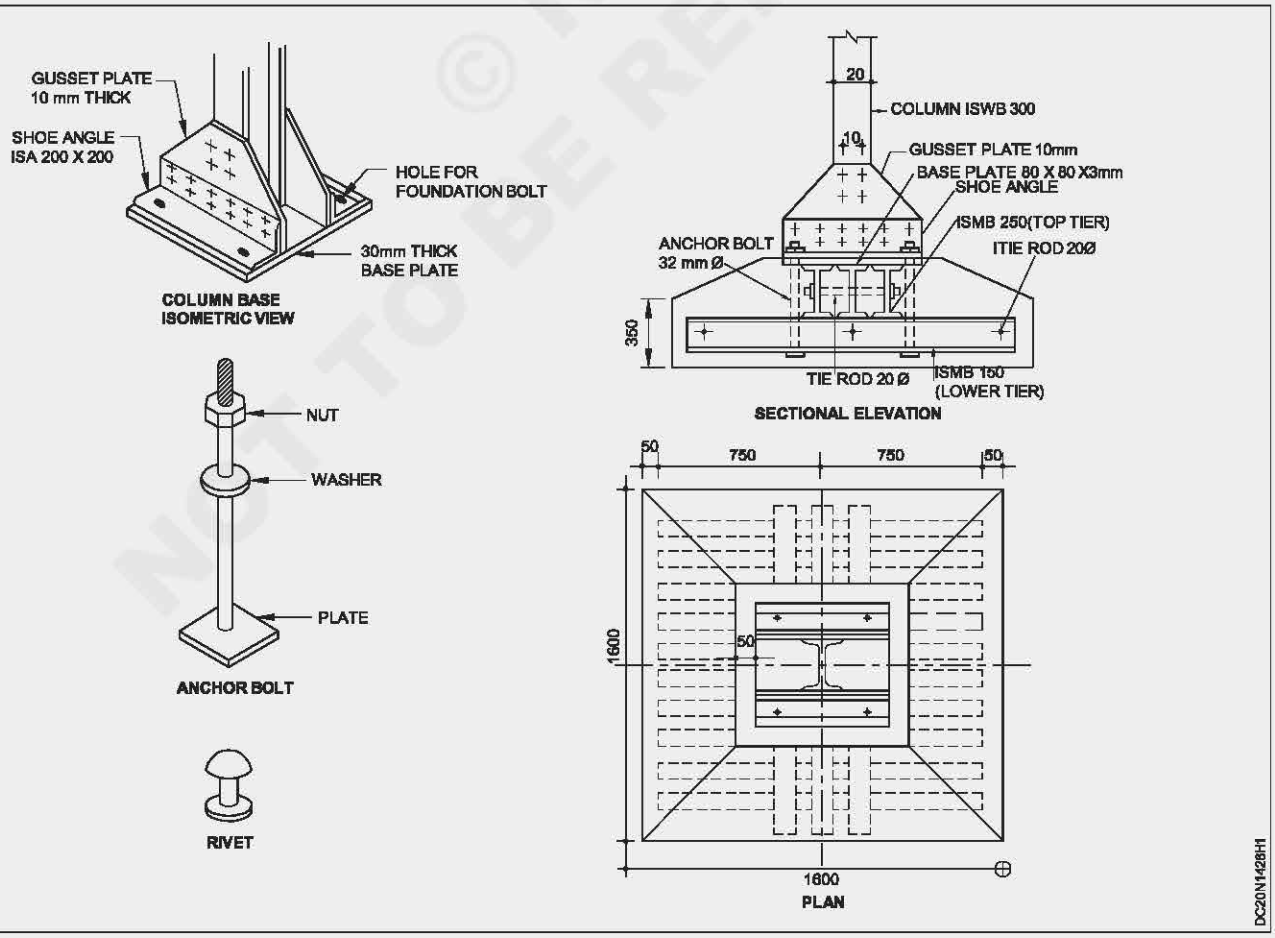
All RSJ are embedded in 2000mmX2000mm cement concrete

Clear cover - 50 mm

Draw the top view and cross section of a grillage foundation (Fig 1)

- Draw the outline of the footing 2000mm X 2000mm
- Draw the arrangement of RSJ ISMB150 in the lowertiers and RSJ IAMB 250 in the upper tiers
- Draw sectional top view of column I SWB300 and complete the plan
- Draw projection lines and complete the sectional elevation as shown in figure

Fig 1



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Deep foundation - Pile foundation

Objective: At the end of this exercise you shall be able to
- **develop details of pre cast pile.**

PROCEDURE

TASK 1 : **Draw the cross and vertical section of precast pile**

Data:

The size of the pile -300 m x 300 mm

Length of pile - 8000 mm

Clear cover - 40 mm

Depth of cast iron shoe -200 mm

Main bars 25 mm Φ 4 nos. stirrups 10 mm Φ dia spacing as shown in (Fig 1)

- Draw the cross section of pile as shown in (Fig 1).
- Project the vertical section of pile
- Draw the bars as per fig shown and complete the drawing.

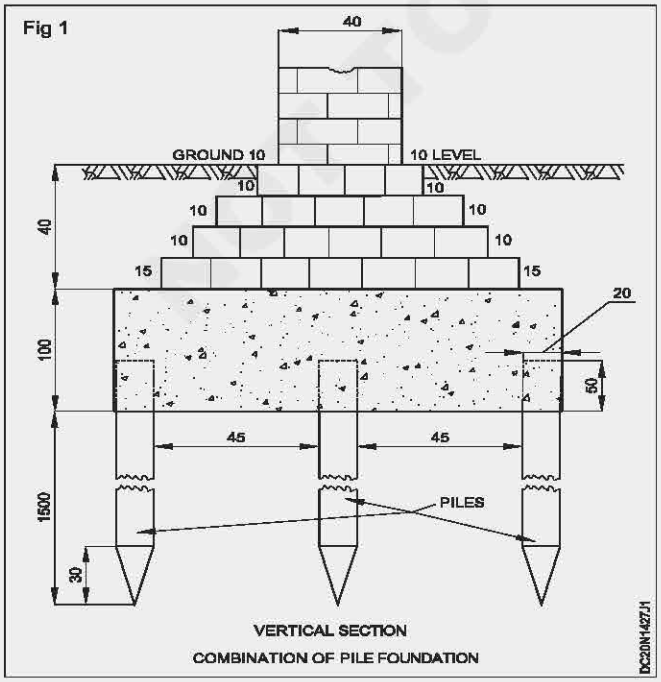
Pile foundation

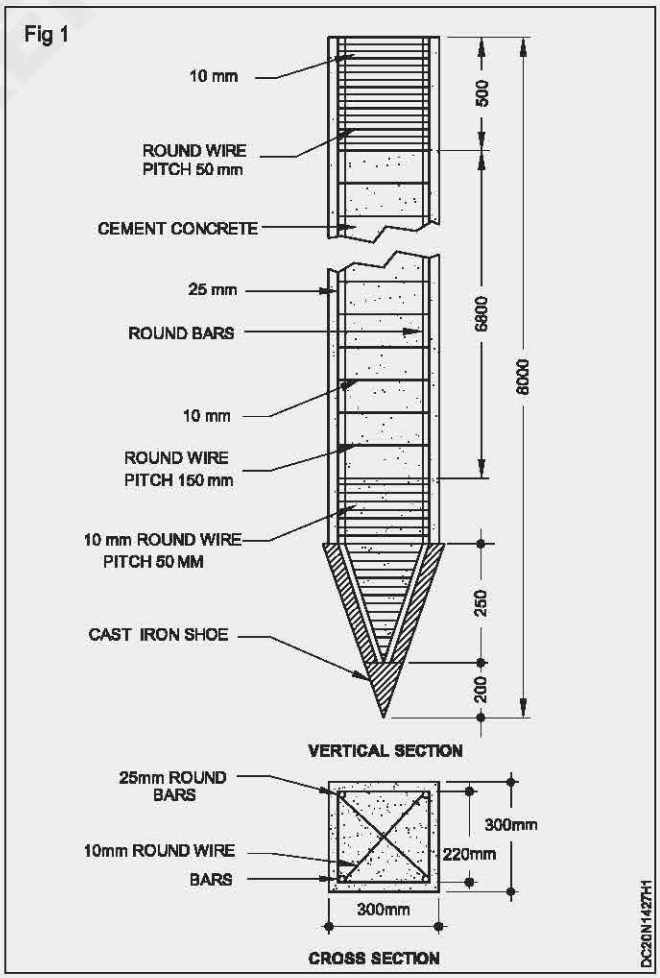
Objectives: At the end of this exercise you shall be able to
- **draw the combination of pile foundation**
- **draw the detail of pre cast pile foundation**
- **draw the cast in situ pile foundation**
- **draw the wooden pile foundation.**

TASK 1 : **Draw the vertical section of combination of pile foundation as shown in Fig 1.**

Data

- The size of pile = 20 x 20 cm
- Length of pile = 1500 cm
- Depth of cast iron shoe = 30 cm
- Size of brick column = 40 x 40 cm
- Depth of cement conc. bed = 100 cm
- Depth of footings = 40 cm
- Concrete footing offset = 15 cm
- Brick footing offset = 10 cm





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Deep foundation - Drawing of raft foundation

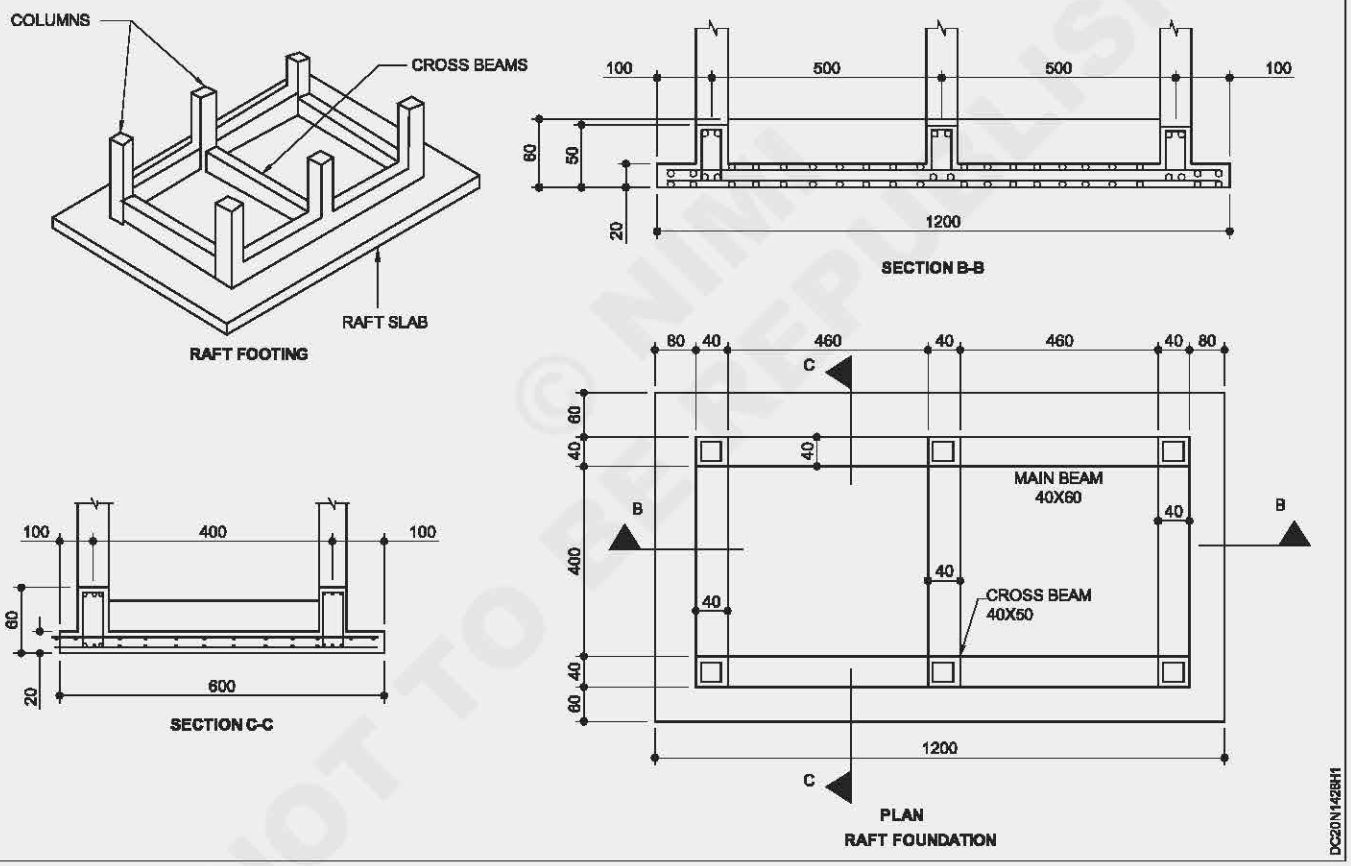
Objective: At the end of this exercise you shall be able to
- **draw the cross section of raft foundation.**

PROCEDURE

TASK 1 : **Draw plan, section and three dimensional view of a raft foundation (Fig 1)**

- Draw plan of overall size 1200 x 600 cm
- Draw main beam, up 40 x 60 cross beam 40 x 50 and column 40 x 40
- Mark L-section as BB and Cr section CC
- Draw the cross section CC and show the reinforcement details
- Draw the L- section BB and show the reinforcement details
- Dimension the figure
- Draw the isometric of the raft foundation as shown in figure
- Complete the drawing.

Fig 1



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Deep foundation - Well foundation

Objectives: At the end of this exercise you shall be able to
- **draw the details of well foundation.**

PROCEDURE

TASK 1 : **Draw the cross and vertical section of well foundation (Fig 1, Fig 2)**

Data:

Dia of well - outer 6500 and inner 4900 mm

Steining width - 800 mm

Depth of well - 11000 mm

Thickness of RCC cap -1500 mm

Top seal - 450 mm

Concrete seal - 1500 mm

- Draw the sectional plan of well 4900mm dia (inner) and 6500mm outer and show the reinforcement details.
- Draw the sectional elevation Y-Y by projecting from plan.
- Draw the steining walls, bottom plug, sand filling, top plug and well cap as per the dimensions in the figure
- Show the reinforcement details
- Draw the plain of well cap top layer steel
- Dimension the whole figures and give notes where ever necessary.

Fig 1

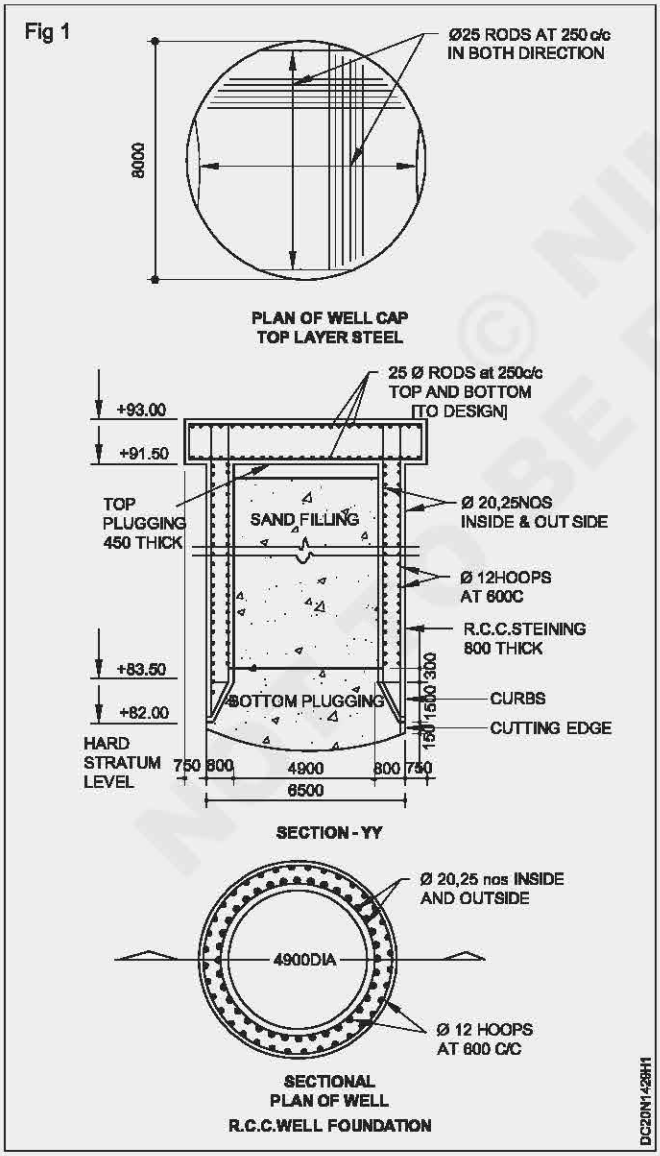
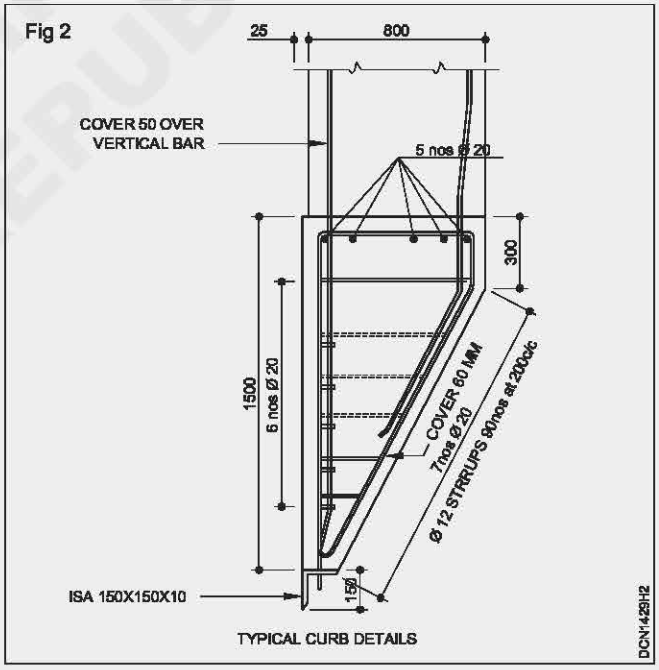


Fig 2



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Special foundation - Inverted arch foundation, stepped foundation

Objectives: At the end of this exercise you shall be able to
- **develop details of inverted arch foundation**
- **draw the details of stepped foundation.**

PROCEDURE

TASK 1 : **Draw the sectional elevation of an inverted arch foundation (Fig 1)**

Data:

Pier width-300 mm

Span - 3000 mm

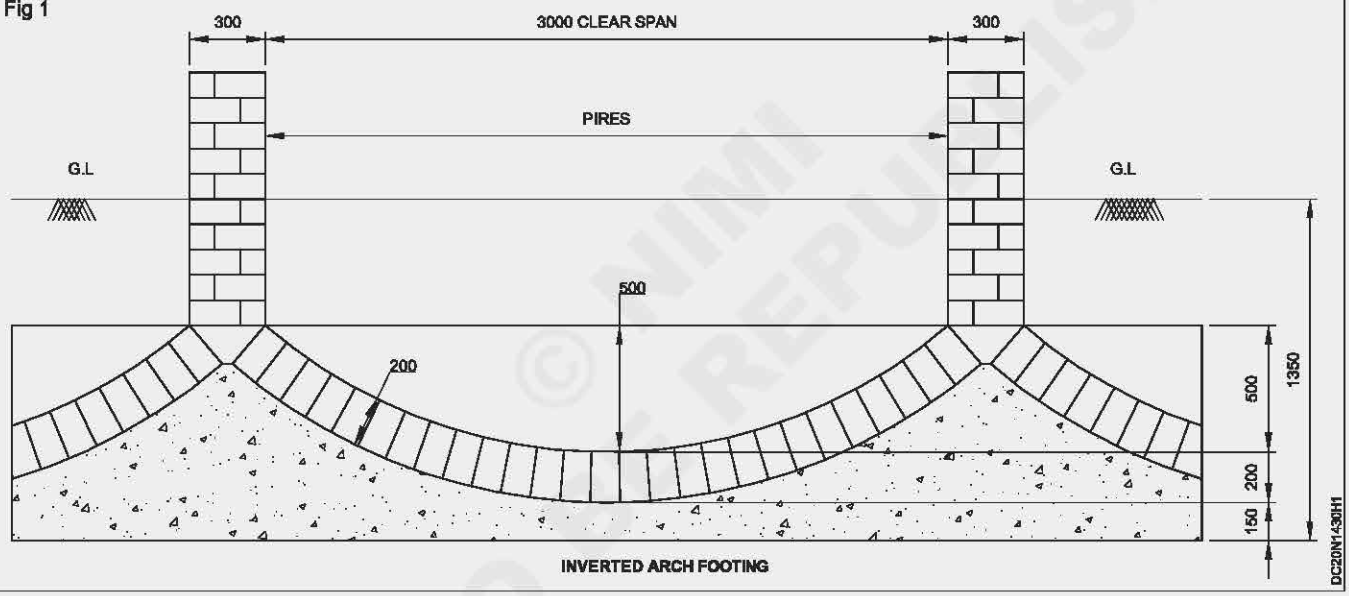
Rise of arch - 500 mm

Thickness of arch ring - 200 mm

Depth of concrete below arch -150 mm

- Draw two piers to given size
- Draw arch ring inversely from the bottom the piers
- Draw concrete block below arch ring
- Complete the sectional elevation

Fig 1



TASK 2 : **Draw the sectional elevation of a stepped foundation (Fig 2)**

Data:

Depth of concrete footing -300 mm

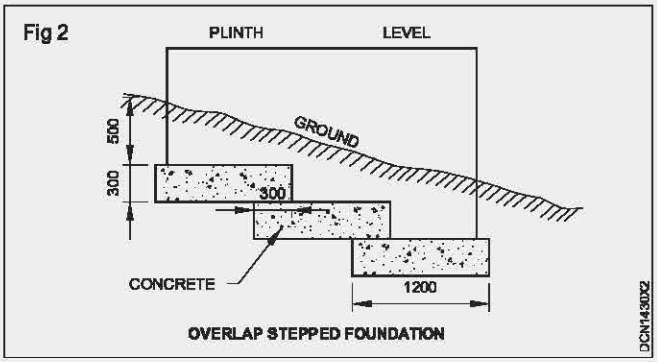
Width of concrete footing-1200 mm

Over lap - 300 mm

Average depth of foundation from ground level-500 mm

- Draw a sloping ground
- Draw concrete footing in stepped manner
- Complete the sectional elevation

Fig 2



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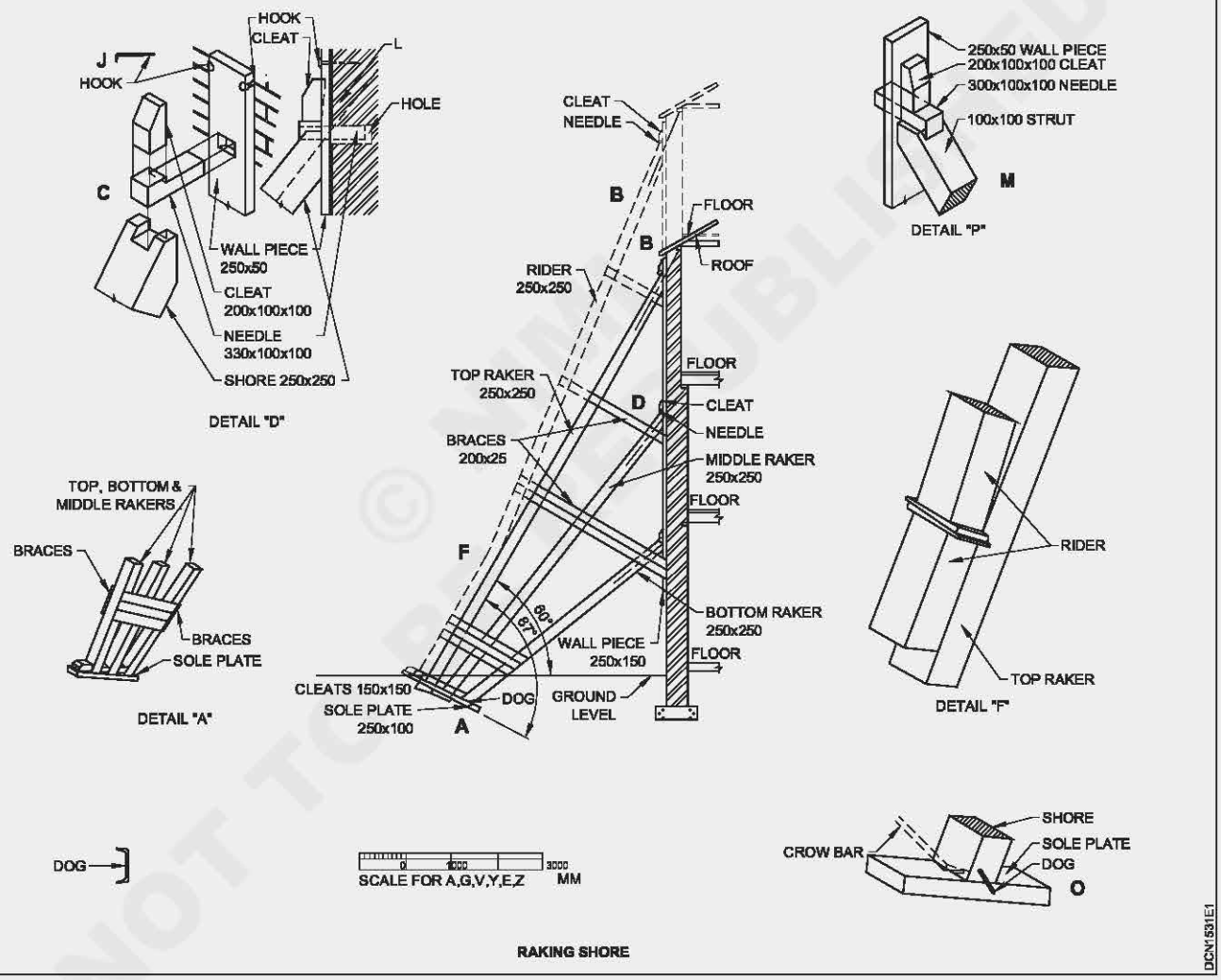
Shoring

Objectives: At the end of this exercise you shall be able to
- **draw the constructional details of raking or inclined shore**
- **draw the constructional details of flying or horizontal shore**
- **draw the constructional details of dead shore.**

PROCEDURE

TASK 1 : **To draw the construction details of raking or inclined shore (Fig 1)**

Fig 1



Size of members

Wallplate -250 x 50 mm, Cleat - 200 x 100 x 100 mm strut 100 x 100 mm

Needle-330x100x100mm, Raker-250x250mm

Sole plate- 250x100mm. Braces-200x25mm

- Draw section of building walls, indicating the different floor levels.
- Draw wall plate of size 250 x 50mm at desired height on the side of a wall which is to be raked.
- Draw the toprakers at an angle of 60 to the ground level and 87 to the sole plate.
- Draw middle and bottom raker.,such that centre line of a raker and the wall should meet at the floor level.
- Draw cleat and needles at top end of eachrakers.
- Draw braces to connect rakers and wall plate.
- Draw hoop iron at bottom of rakers.
- Draw all rakers rest on sole plate.

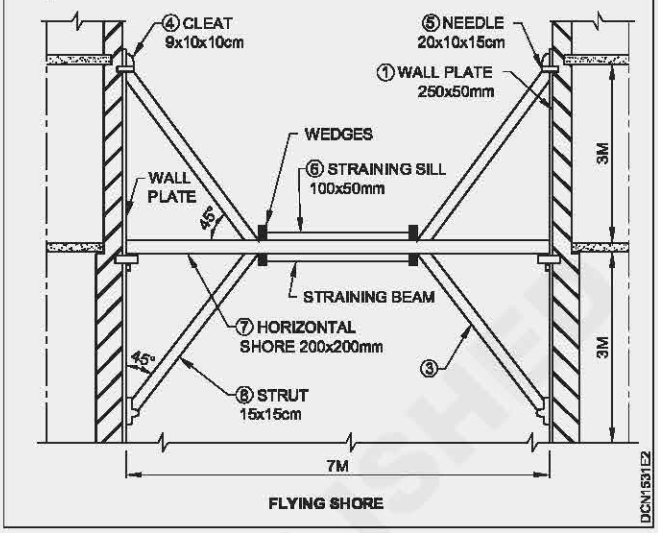
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- Draw in details, the main component parts of a Raking Shore.
- Name and dimension to all the components.

TASK 2 : **To draw the construction details of flying or horizontal shores (Fig 2)**

- Draw the section of two walls opposite to each other,
- Draw the wall plate of size 250 x 50mm on the side of two walls, facing each other at desired height.
- Draw horizontal shore 200x200mm to hold both the walls.
- Draw inclined (45°) strut 150x150mm with the help of wall plate for support horizontal shore.
- Draw needles and cleats, Over the wall plates to fix the struts.
- Draw the straining sill 100x50mm at middle of horizontal shore.
- Draw wedges to fix the straining sill.
- Name and dimension to all the components.

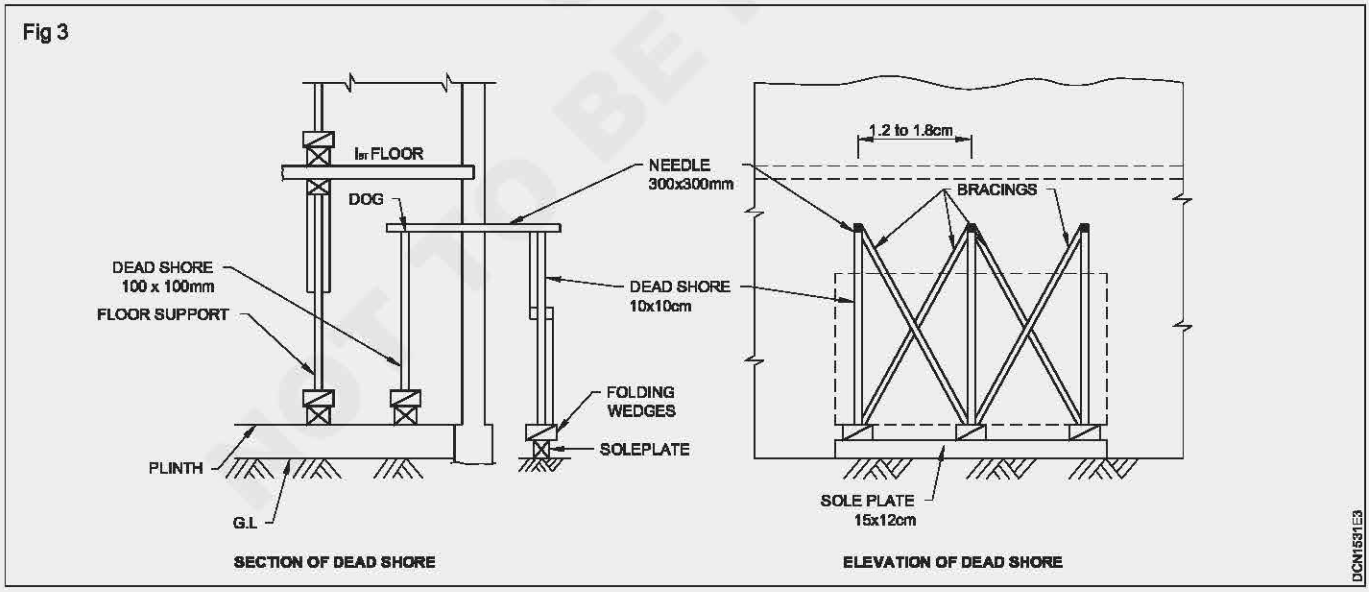
Fig 2



TASK 3 : **To draw the construction details of dead shore (Fig 3)**

- Draw the cross section of existing wall.
- Draw needle(300x300mm) at 1.2 to 1.8m c/c.
- Draw a sole plate150x120mm.
- Draw vertical memberor dead shore 100x100mm.
- Draw wedges at the bottom of Dead shore.
- Draw braces to connect the dead shore.
- Name and dimension to all the components.

Fig 3



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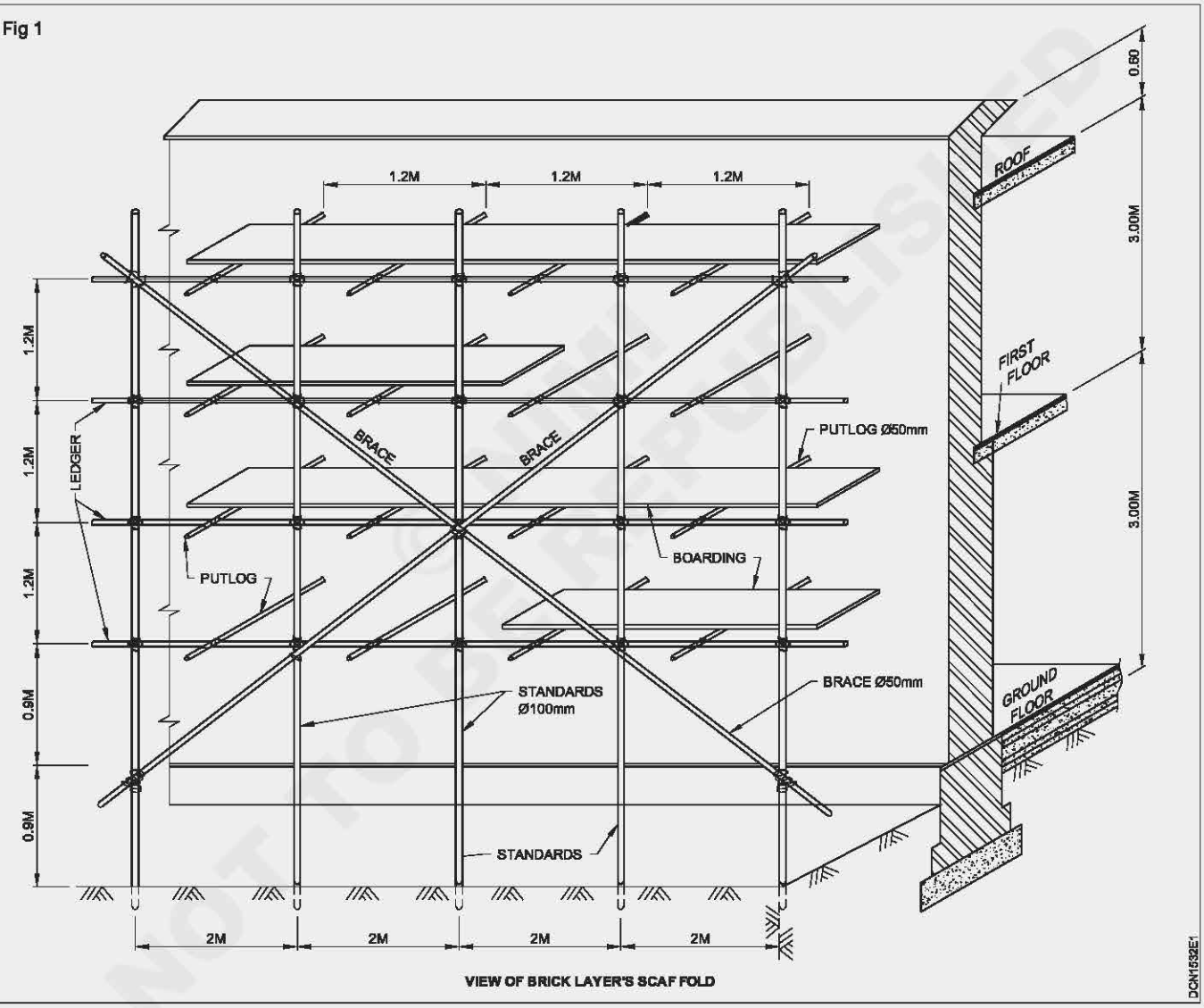
Drawing of scaffolding

Objectives: At the end of this exercise you shall be able to
- **draw single scaffolding (Brick layer's scaffold)**
- **draw double scaffolding (Mason's scaffold)**
- **draw needle scaffolding.**

PROCEDURE

TASK 1 : **To draw single scaffolding (Brick layer's scaffold) (Fig 1)**

Fig 1



- Draw pictorial view of an external surface of a wall to show two floors.
- Draw standards 100mm φ vertically @2m intervals.
- Draw ledgers 80mmφ horizontally @1.2m intervals
- Draw putlogs 50mmφ @1.2m intervals.
- Draw platform 40mm (planks) over putlogs.
- Draw braces 50mm φ diagonally to join standards.

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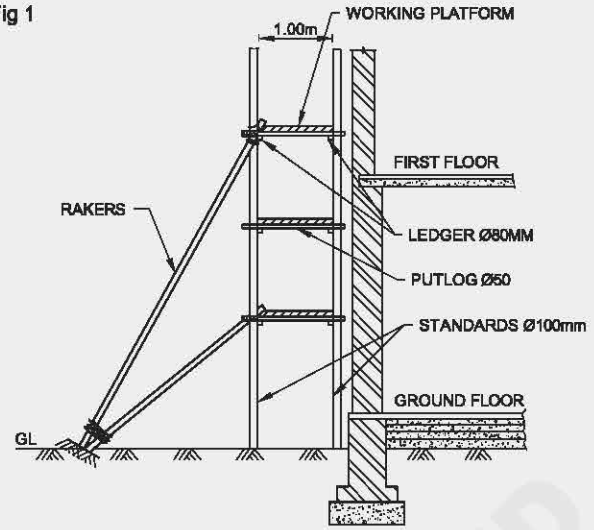
TASK 2 : **To draw double scaffolding (Mason's scaffold) (Fig 2)**

- Draw section of wall to show ground floor & first floor.
- Draw standards 100mm ϕ vertically,in first row 20cm. away from the wall.

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- Draw standards in second row,1m away from the first raw.
- Draw ledgers 80mm ϕ connected to the standards.
- Draw putlogs 50mmϕ connected to the ledgers in each row.
- Draw platform 40mm(planks) over putlogs.
- Draw rakers and cross braces to strengthen the scaf folding.

Fig 1

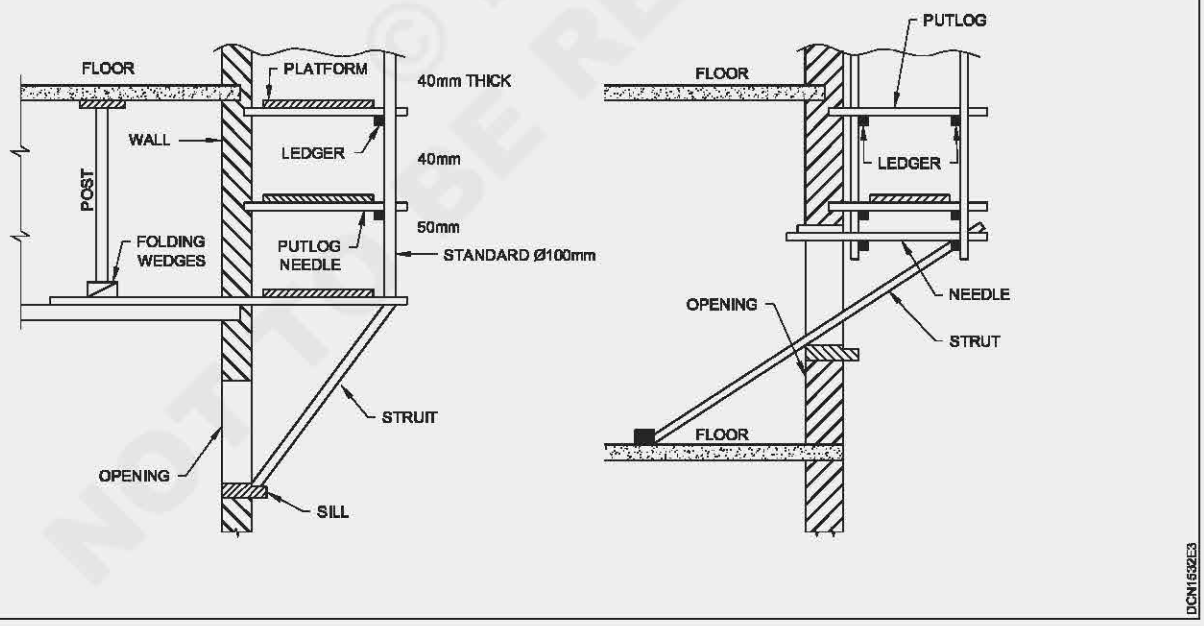


MASON'S SCAF FOLDING WITH RAKING SHORE

TASK 3 : **To draw needle scaffolding (Fig 3)**

- Draw the section of upper floors.
- Draw the needle horizontally 1.2 m externally and in ternally.
- Draw the strut at an angle 60°
- Draw the standards vertically keep at a distance, say 1.2m c/c.
- Draw ledgers, putlogs and platform.

Fig 3



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Underpinning

Objectives: At the end of this exercise you shall be able to
- **draw the pit method of underpinning**
- **draw the pile method of underpinning.**

PROCEDURE

TASK 1 : **To draw pit method of underpinning (Fig 1)**

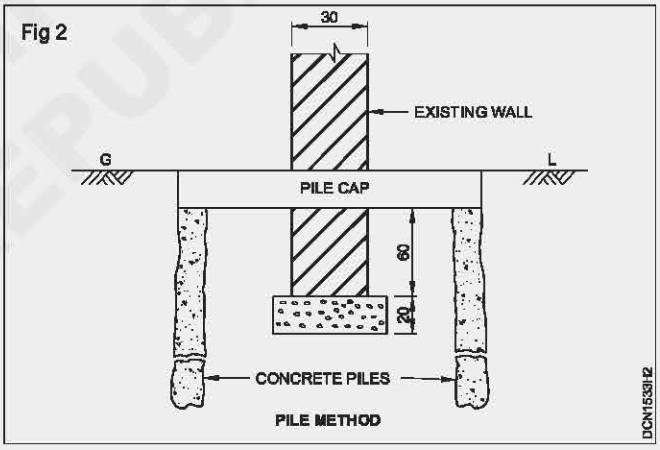
- Draw the existing wall.
- Draw the holes in the wall.
- Draw the needle with the bearing plate through these holes.
- Draw the jack to support this needle.
- Draw the pit at required depth.
- Draw the new foundation.

If space to support needles on outside is not avail able, the cantilever needles, projecting inside and provided with fulcrum and loading may be adopted.

TASK 2 : **To draw pile method of underpinning (Fig 2)**

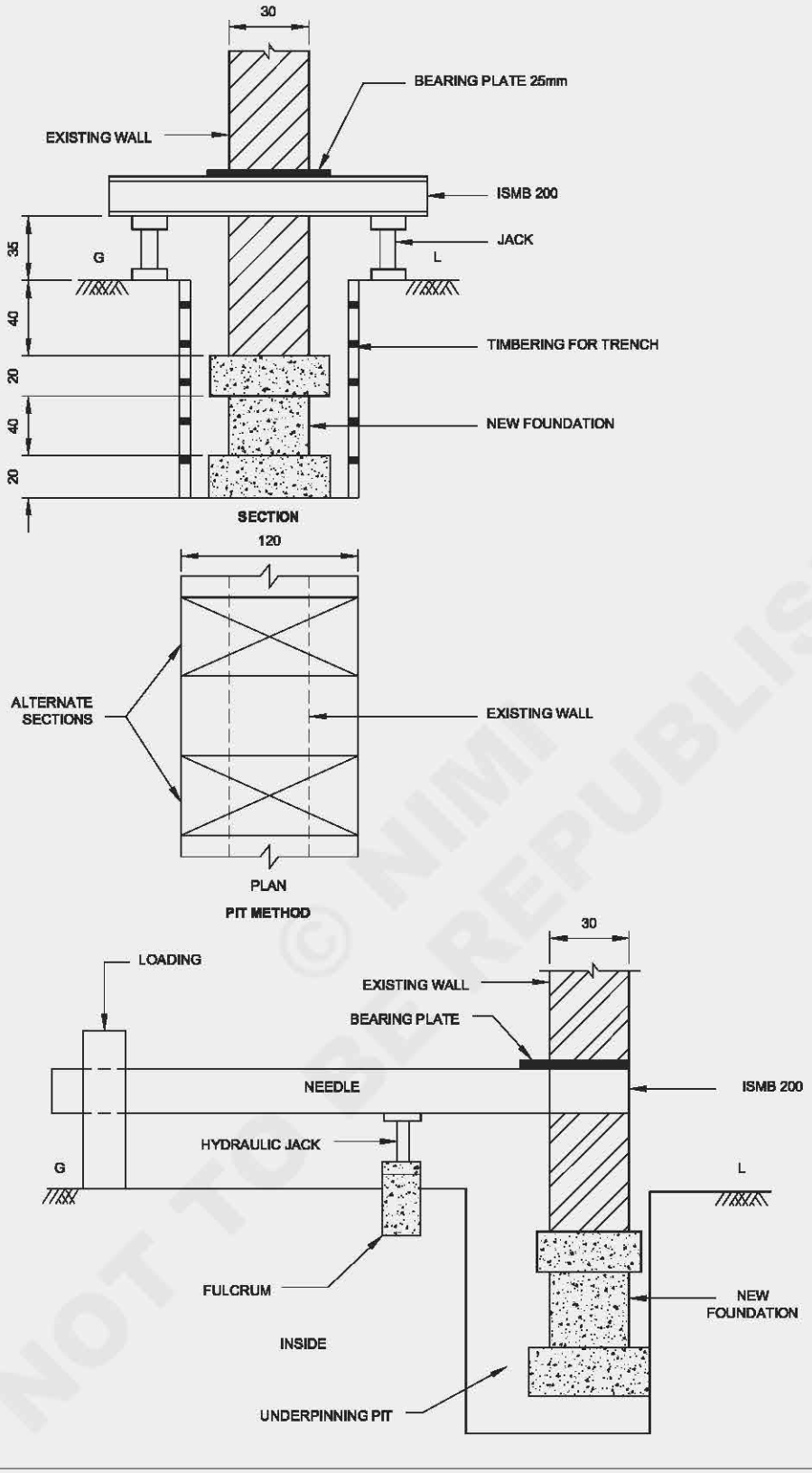
- Draw the existing wall.
- Draw the holes in the wall.
- Draw the needle in the form of pile cap through this hole.
- Draw piles on both side of the wall.
- Draw the existing wall.

Fig 2



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Fig 1



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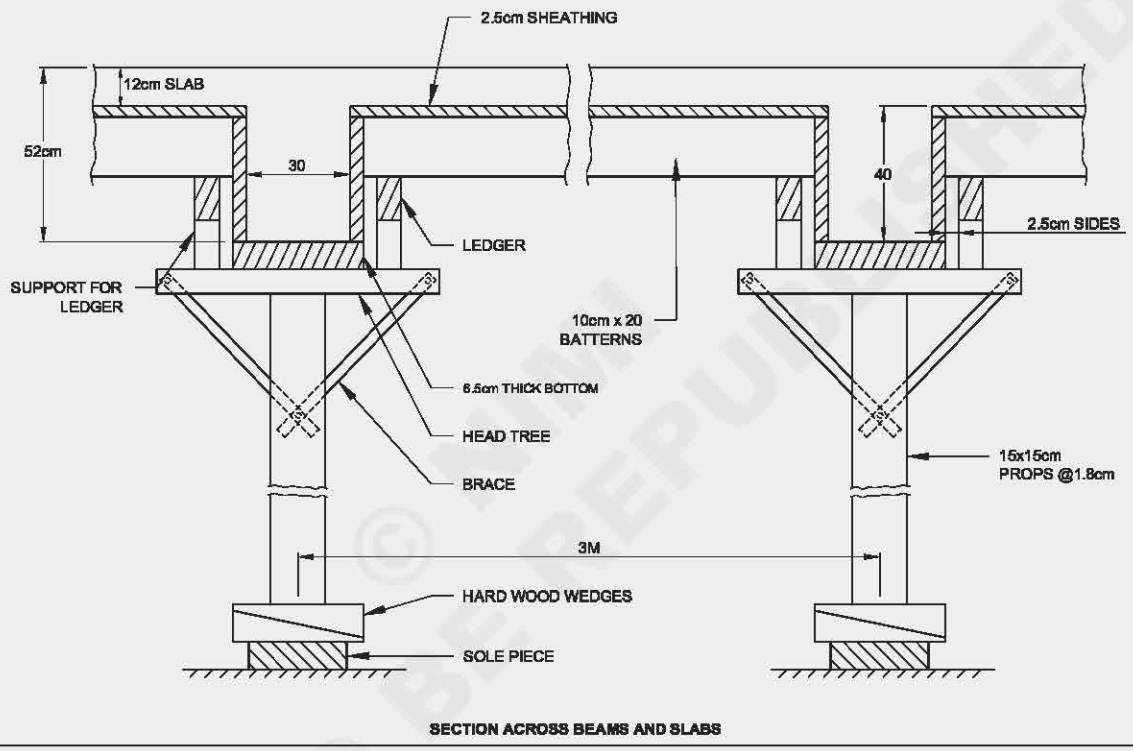
Timbering - Drawing of formwork

Objectives: At the end of this exercise you shall be able to
- **draw the elevation of formwork for beams and slabs.**
- **draw the details of form work for square or rectangular column**
- **draw the details of form work for circular column**
- **draw the detail of form work for R.C.C wall.**

PROCEDURE

TASK 1 : **To draw form work for beams and slabs (Fig 1)**

Fig 1



SECTION ACROSS BEAMS AND SLABS

- Draw a span of 3m.
- Draw vertical post 15x15cm.,
- Draw slab thickness 12cm at suitable floor height.
- Draw beam size30x40cm
- Draw 2.5cm thick sheathing under the slab.
- Draw wooden battens 10x20cm to support the sheathing
- Draw 3cm thick sheathing for the side of beams.
- Draw 6.5 cm thick bottom sheathing for the beams.
- Draw cleats 10x2x3cm fixed on the side forms.
- Draw ledger 5x12cm to support the ends of battens.
- Draw head under the beam form.
- Complete the drawing of timber formwork for R.C.C. beam and slab as in (Fig 1).

— — — — — — — —

TASK 2 : **To draw formwork for square column (Fig 2)**

- Draw the outline of 300x300mm square coloumn.
- Draw 35 mm thick wooden board around the square.
- Draw batten 50x100mm size front and rear side of plan.
- Draw yokes 100x100mm size of left and right side in plan.
- Draw 20mm bolt to connect the yokes
- Draw wedges to tighten the formwork.
- Complete the drawing of plan.
- Draw isometric view to formwork of square column.

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Fig 2

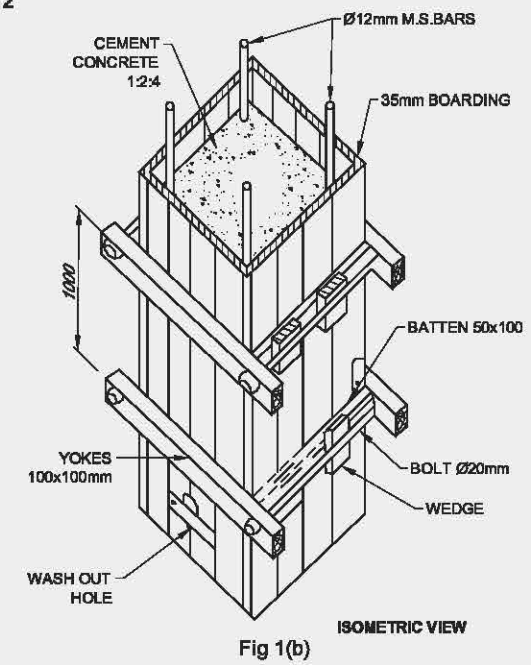


Fig 1(b)

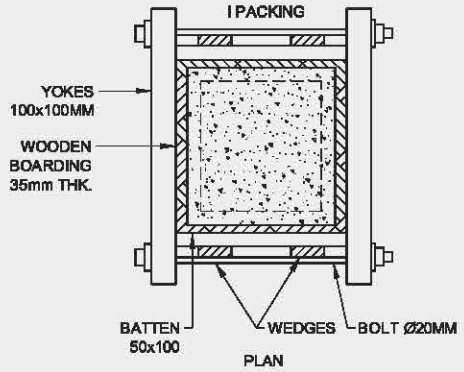


Fig 1(a)

DETAILS OF TIMBER FORM WORK FOR A SQUARE OR RECTANGULAR R.C.C. COLUMN

DCN1534H2

TASK 3 : **To draw formwork for circular column (Fig 3)**

- Draw the outline 300mm circular column.
- Draw 6 no. 12mm bars.
- Draw stirrups 6mm around the bars.
- Draw 35mm thick sheeting around the column.
- Draw collar around the sheeting.
- Draw cleat at corner of column.
- Draw 20 mmΦ bolt to connect the collar and tighten the formwork.
- Complete the plan of timber formwork for circular column.
- Draw the elevation of column of formwork as in (Fig 3).

TASK 4: **To draw formwork for wall (Fig 4)**

1 Draw 100mm thick concrete wall.

2 Draw a base for the wall in suitable size.

3 Draw timber sheets 40x40mm on both side of the wall.

4 Draw studs 200x150mm to support timber boarding.

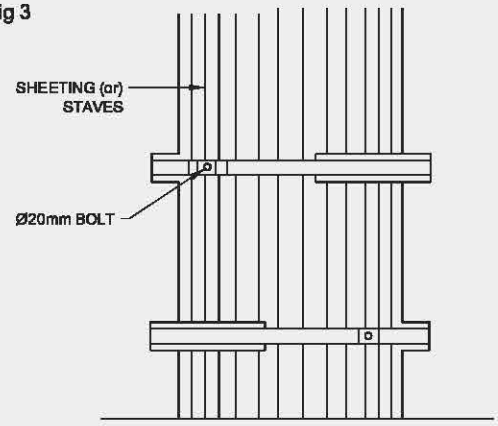
5 Draw M.S.bar 12mm to connect the studs.

6 Draw braces 120x50mm ,one end support the studs and other end rest on stakes.

Complete the drawing of formwork for walls (Fig 4).

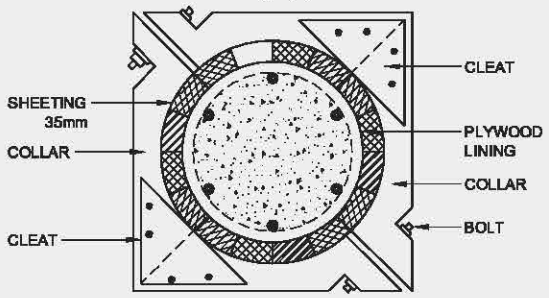
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Fig 3



ELEVATION

Fig 2(b)



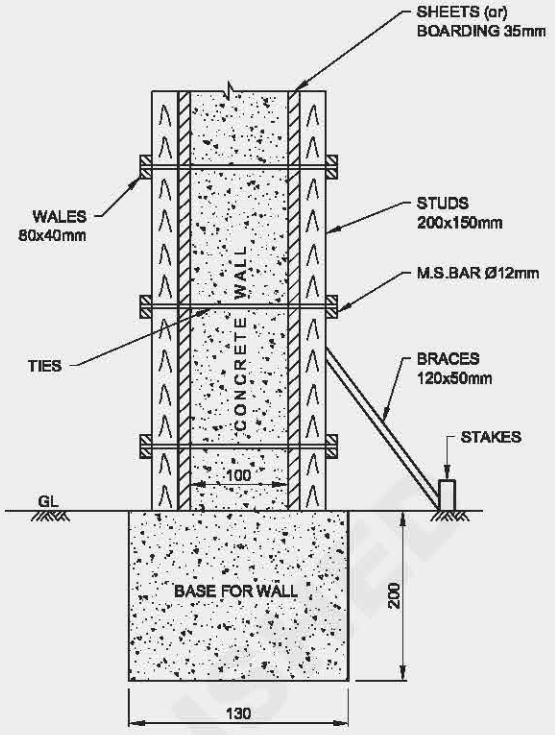
PLAN

Fig 2(a)

DETAILS OF TIMBER FORM WORK FOR A CIRCULAR R.C.C. COLUMN

DCN1534H3

Fig 4



FORM WORK FOR WALL

DCN1534H4

Timbering - Centering of arches

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

- **draw isometric view of centering of arches with turning piece**
- **draw isometric view of centering of arches for wider soffits and smaller span**
- **draw the elevation of centering of semicircular arch and section.**

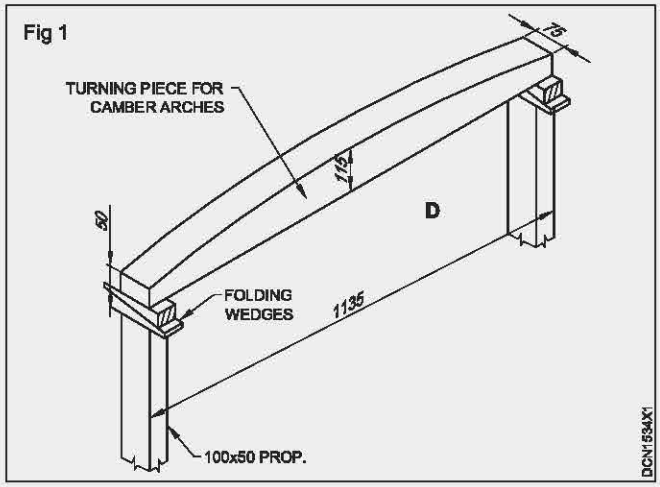
PROCEDURE

TASK 1 : **To draw isometric view of centering of arches with turning piece(Fig 1)**

(For 10 cm wide soffit)

- Draw a span of 1.3 m.
- Draw a prop 100 x 50 mm at both end of span.
- Draw75 x 50 mm at both end and 115mm at the cen tre of turning piece over the floding wedges.
- Draw a slant line (hypotenuse) towards at both ends.
- Complete the drawing of turning piece.

Fig 1

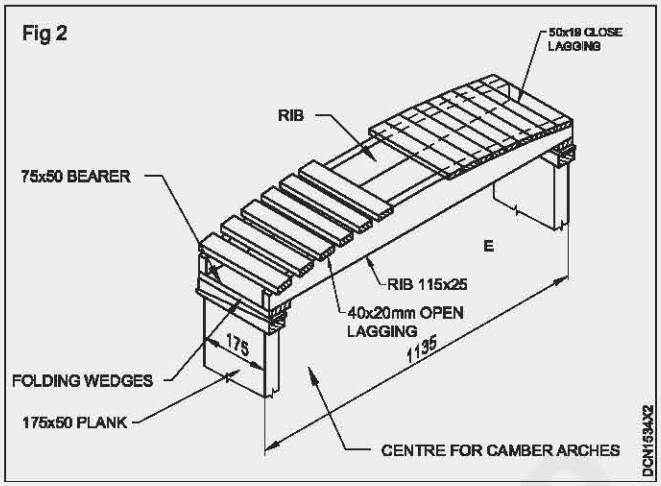


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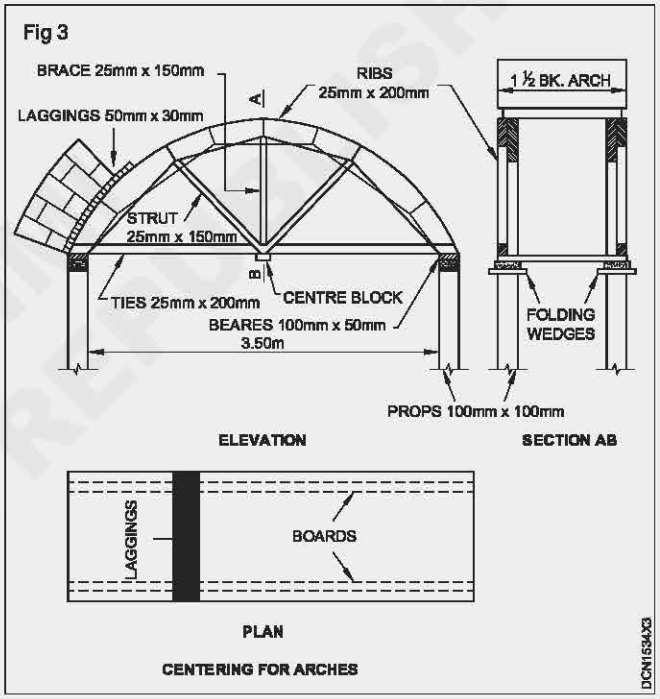
TASK 2 : **To draw isometric view of centering of arch with wider soffit and smaller span (Fig 2)**

- Draw the isometric view of turning piece as in procedure 1.
- Draw turning laggings of lagging of size 40 x 20 mm over the turning piece.
- Complete the drawing.



TASK 3 : **To draw elevation of centring for semi circular arch and section (Fig 3)**

- Draw a span of 3.5 m.
- Draw prop at both ends.
- Draw lower ties 25 X 200 mm..
- Draw ribs 25 x 200mm and strut 25 x 150mm
- Draw brace 150 x 25mm
- Draw laggin 50 x 30 mm.
- Draw semi circular arch
- Complete the drawing of centering for semicircular arch.
- Draw the section view and plan by projecting from elevation.



Timbering - Foundation trenches

Objectives : At the end of this exercise, you shall be able to
- **draw isometric view of timbering for trenches in firm ground**
- **draw isometric view of timbering for trenches in moderately firm ground**
- **draw isometric view of timbering for trenches in loose and waterlogged grounds.**

PROCEDURE

TASK 1: **To draw the isometric view of timbering for trenches in firm ground** (Fig 1)

1 Draw isometric square trench of size, 2.5 x1.2x1.2m.

2 Draw vertical sheets /poling boards of size 20x4cm, opposite each other at 1.8 m centre to centre, inside the trench.

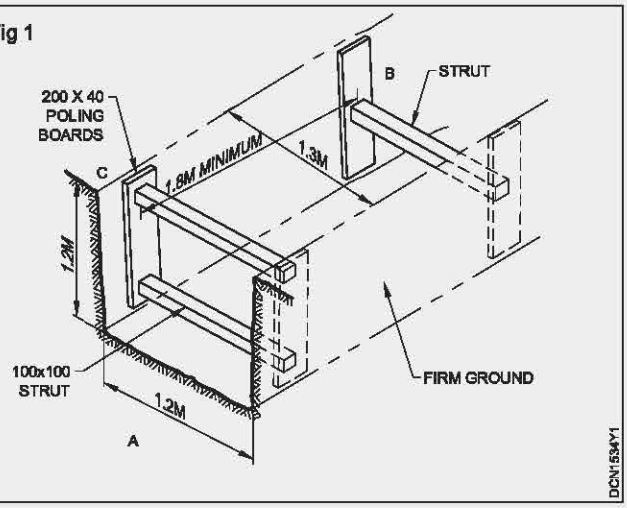
3 Draw struts of size 10x10 cm one at bottom and an other at top for holding the poling boards inside the trench.

4 Draw one more strut at other end at middle.

5 Complete the drawing of timbering in firm ground.

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Fig 1



TASK 2 : **To draw the isometric view of timbering for trenches in moderately firm ground.(Fig 2)**

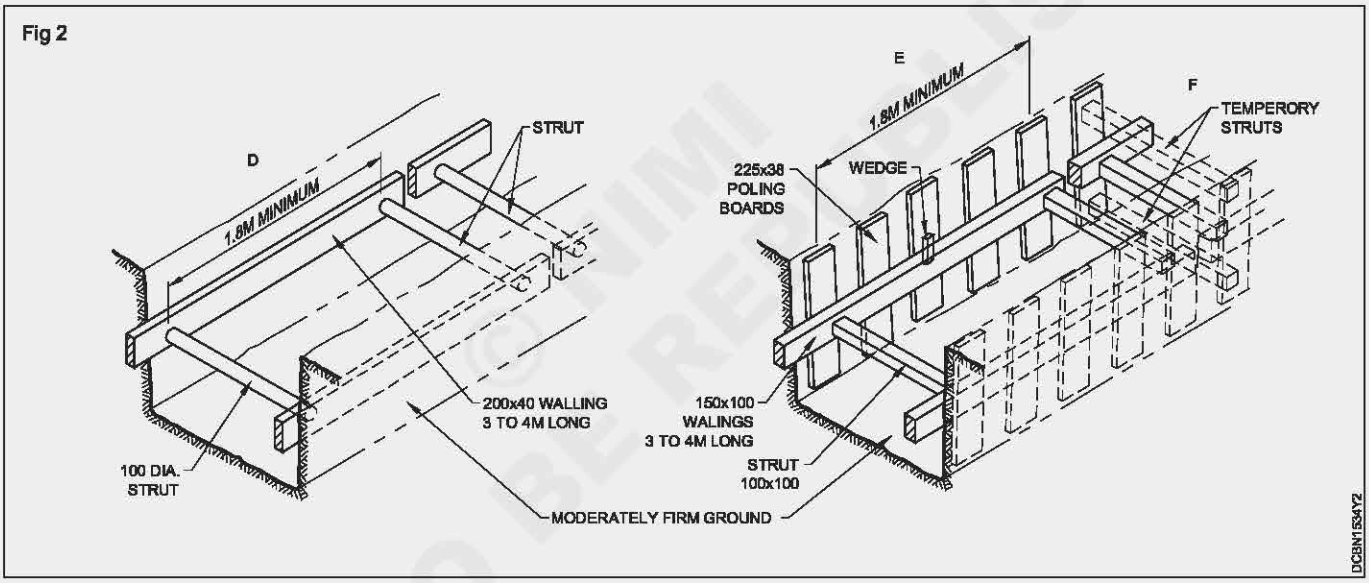
1 Draw trenches similar to firm ground soil.

2 Draw walling of size 20x4cm on both side of trench 3 to 4m long.

3 Draw 10cm Ø strut to support the walling on both sides.

4 Complete the drawing of timber in moderately firm ground.

Fig 2



TASK 3 : **To draw isometric view of timbering for trenches in loose and water logged grounds.(Fig 3)**

1 Draw the trenches in size 1.2 m square and 2.5 m length.

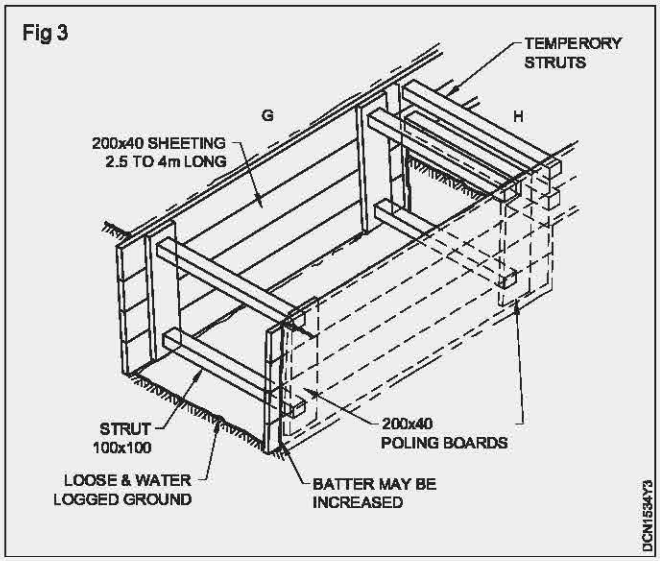
2 Draw sheeting of size 20 x 4 cm and 2.5 to 4 m long at the side of trenches closely on both sides.

3 Draw poling boards of size 20 x 4 cm ,1.8 m c/c on both the sides.

4 Draw strut size 10 x10 cm provided at both ends of sheeting.

5 Complete the drawing of timbering to trenches in loose and water logged grounds.

Fig 3



Methods of damp proofing

Objectives: At the end of this exercise you shall be able to
- **draw details of damp proofing in basement**
- **draw details of damp proofing in external wall**
- **draw details of damp proofing in internal walls**
- **draw details of damp proofing by cavity wall.**

PROCEDURE

TASK 1 : **Draw 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 Draw the section of foundation concrete of thick 200 mm.

2 Draw horizontal D.P.C. of thick 30mm.

3 Draw vertical outer protective wall of ½ brick thick.

4 Draw vertical D.P.C. of 20 mm thick up to 150 mm above ground level.

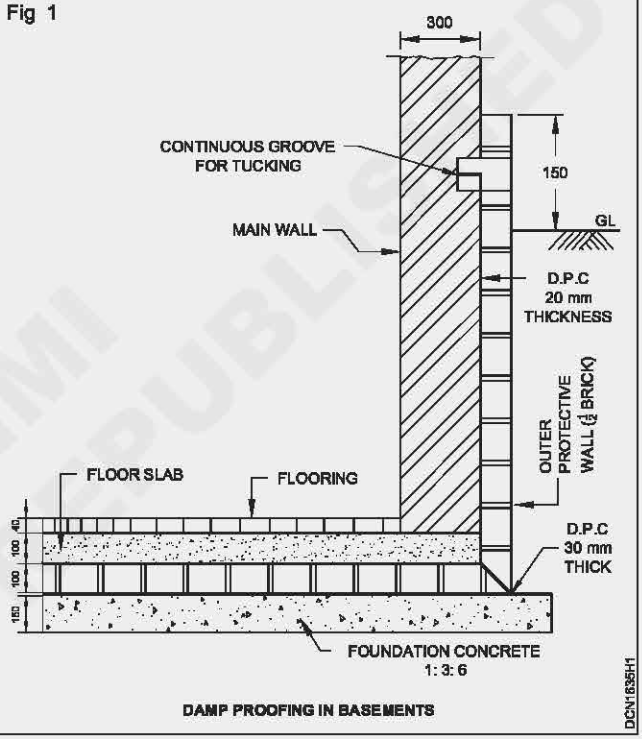
5 Draw 100 mm thick brick layer over D.P.C.

6 Draw 100 mm thick floor concrete over brick layer.

7 Draw vertical main wall of 300mm thick.

8 Draw flooring above the floor concrete.

Fig 1



DAMP PROOFING IN BASEMENTS

9 Show the proper conventional symbols and mark the important parts.

TASK 2: **Draw the details of damp proofing in external wall (Fig 2)**

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 Draw the section of wall and basement.

2 Draw 75 mm thick lean concrete.

3 Draw 30 mm thick D.P.C. over lean concrete.

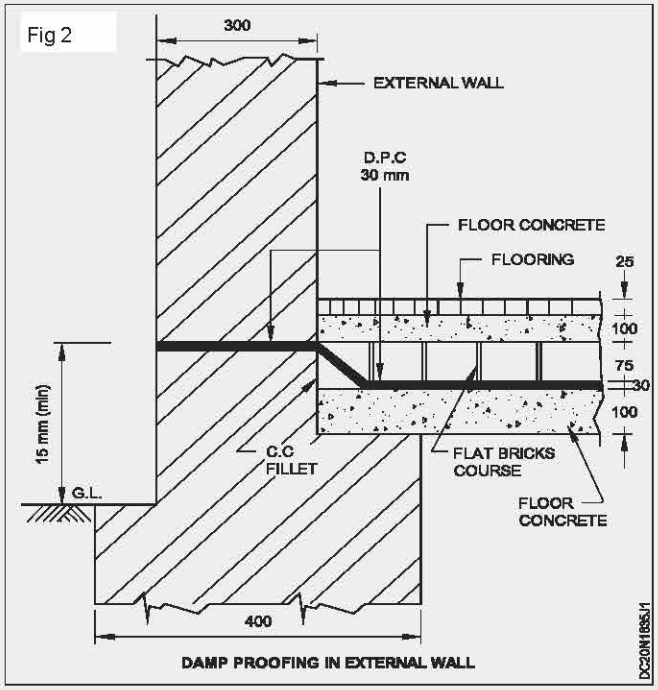
4 Draw 75 mm thick brick course over D.P.C.

5 Draw 100 mm thick floor concrete over the layer of bricks.

6 Draw 25 mm thick flooring over concrete layer.

7 Show conventional symbols and mark the parts.

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TASK 3 : **Draw details of damp proofing in internal wall (Fig 3)**

(two ground floors at different levels are connected by an internal wall)

Data:

For drawing lower floor, procedure same as.

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.

TASK 4 : **Draw details of damp proofing , by cavity wall (Fig 4)**

Data :

Thickness of outer wall-100 mm

Thickness of inner wall -200 mm

Thickness of Cavity-50 to 75 mm

Metal ties-900 mm c/c horizontally and 450 mm vertically.

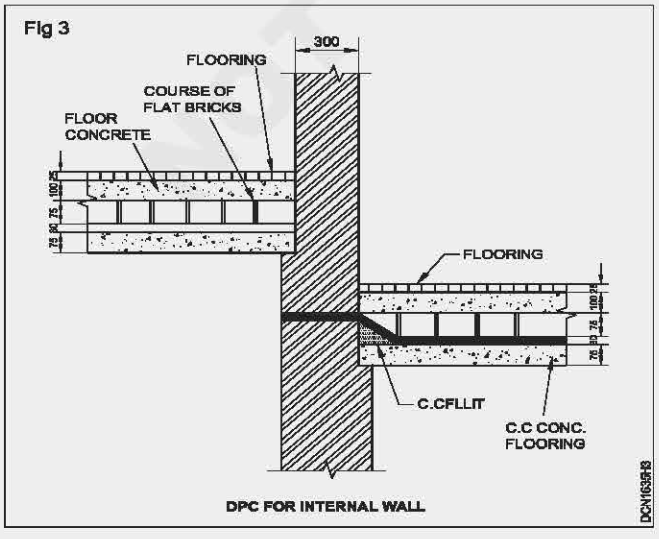
1 Draw section of foundation, floor, and wall as shown in figure.

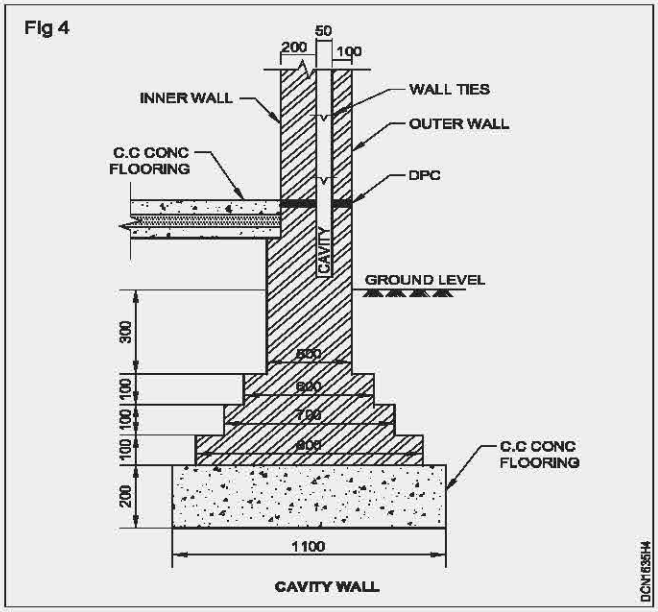
2 Draw the inner wall of thickness 200 mm and outer wall of thickness100 mm leaving a cavity of 50 mm in between them.

3 The cavity starts from 15 to 30 cm above ground level.

4 Draw D.P.C. at floor level for inner and outer walls.

5 Draw the metal ties at a distance of 450 mm c/c vertically.





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Methods of damp proofing in roofs

Objectives : At the end of this exercise, you shall be able to
- **draw details of damp proofing in flat roof and parapet wall**
- **draw details of damp proofing of flat roof by tar felting**
- **draw details of damp proofing by mud phuska terracing with tile**
- **draw details of damp proofing in pitched roof.**

TASK 1 : **Draw the details of damp proofing at the junction of flat roof and parapet (Fig 1)**

1 Draw the section of wall 300 mm thick, with coping as shown in figure.

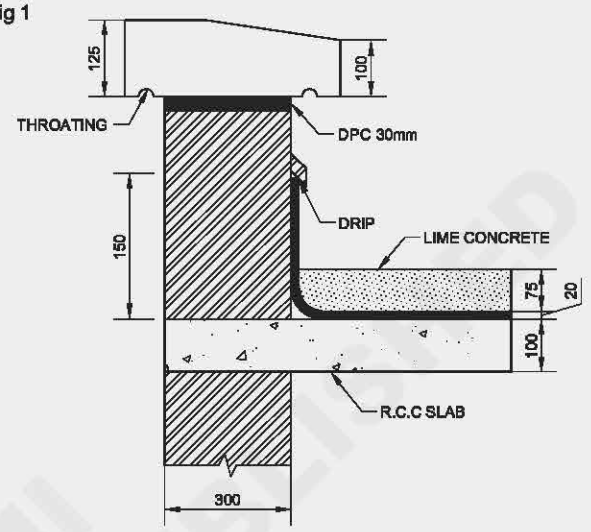
2 Draw the R.C.C. slab of 100 mm thick, at suitable level within the wall.

3 Draw 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 150 mm.

4 Draw 75 mm thick lime concrete over D.P.C.

5 Draw D.P.C. below coping and complete the drawing as shown in figure.

Fig 1



METHOD OF PROVIDING D.P.C IN FLAT ROOF AT THE COPING WALL AND ROOF JUNCTION

DCN1635J1

TASK 2 : **Draw the details of damp proofing of flat roof by bitumen felting (Fig 2)**

1 Draw section of wall 300 mm thick, with coping as shown in figure.

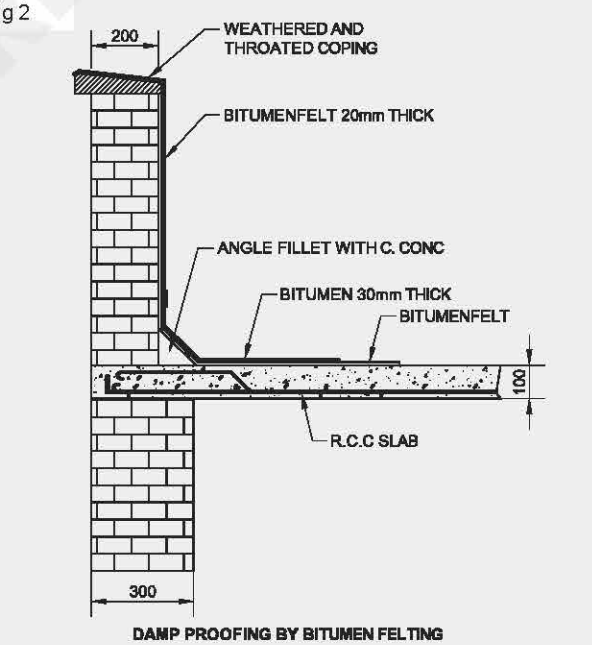
2 Draw the R.C.C. slab of 100 mm thick, at suitable level.

3 Draw an angle fillet with cement concrete at the junction of slab and parapet wall.

4 Draw a line to show bitumen felt over the slab and side of the parapet wall, upto coping.

5 Draw a thick line to show the hot bitumen spread on the layer of bitumen felt.

Fig 2



DAMP PROOFING BY BITUMEN FELTING

DC20N1635X1

TASK 3 : **Draw the details of damp proofing by mud phuska terracing with tile (Fig 3)**

1 Draw section of wall and slab

2 Draw a line to show the bitumen spray, over the slab.

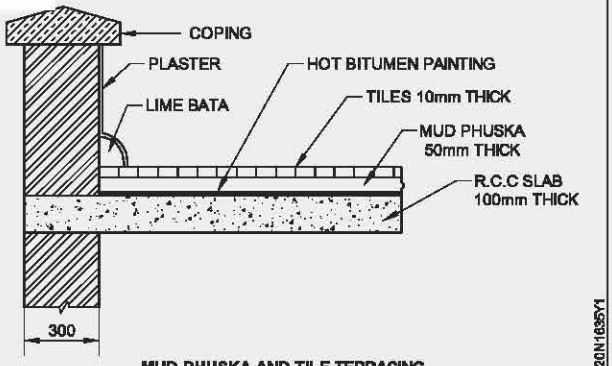
3 Draw mud phuska terrace 80 mm thick over the bitumen layer.

4 Draw tiles over 13 mm thick mud mortar.

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5 Draw lime/cement concrete at the junction of paved tiles and side of parapet, as shown in figure.

Fig 3



MUD-PHUSKA AND TILE TERRACING

TASK 4 : **Draw the details of damp proofing in pitched roof (Fig 4)**

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 Draw section of wall.

2 Draw the stone bed block.

3 Draw main tie beam.

4 Draw principal rafter at an angle of 30 .

5 Draw cleat and purlin over the principal rafter.

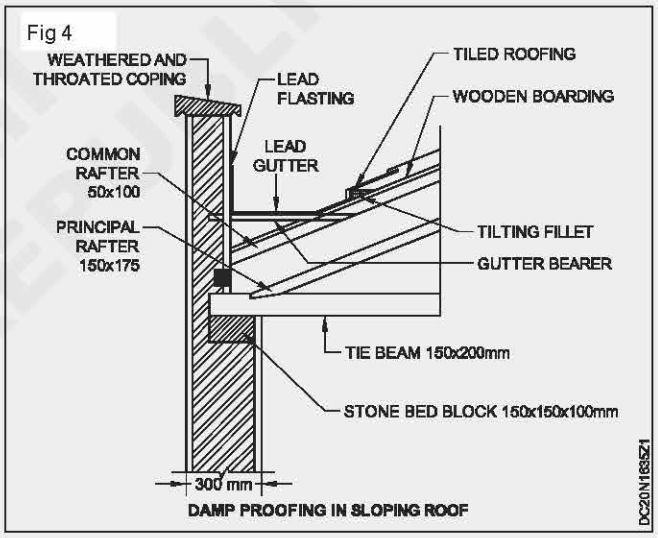
6 Draw common rafter at a distance of 150 mm above the principal rafter.

7 Draw 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.

Fig 4



DAMP PROOFING IN SLOPING ROOF

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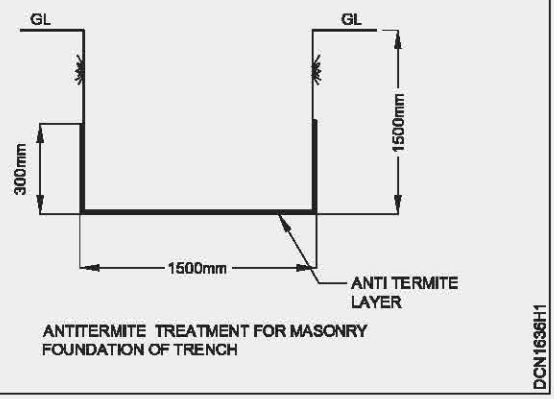
Drawing of anti-termite treatment for building

Objectives: At the end of this exercise you shall be able to
- **draw the anti-termite treatment for masonry foundation of trench**
- **draw the anti-termite treatment for masonry wall.**

PROCEDURE

TASK 1 : **To draw the anti-termite treatment for masonry foundation as shown in Fig 1**

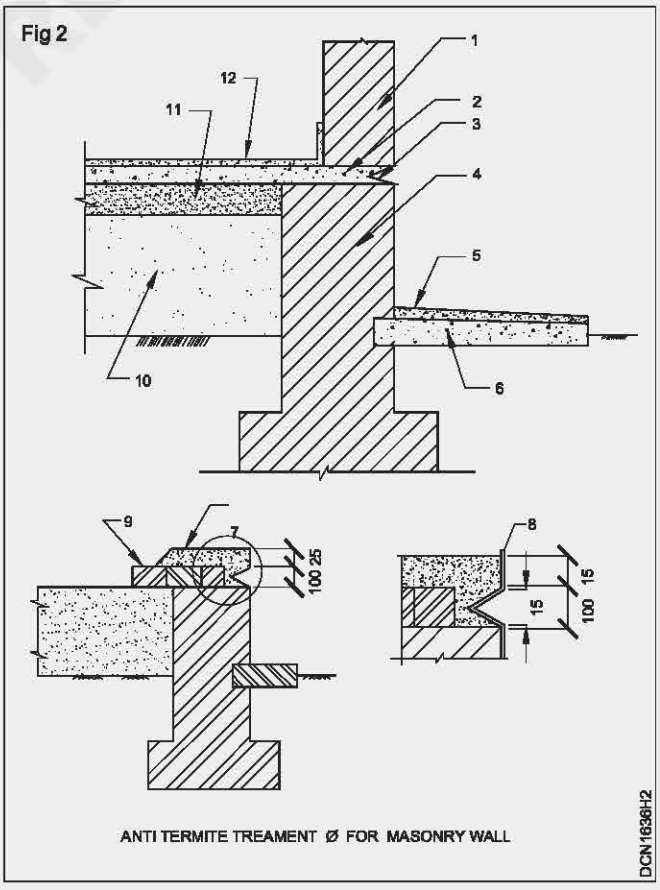
Fig 1



TASK 2 : **To draw the anti-termite treatment for masonry wall as shown in Fig 2**

1 Masonry super structure
2 Cement concrete sub floor
3 Anti termite groove
4 Masonry plinth wall
5 Cement concrete topping
6 Lime concrete apron
7 Centre cement concrete 1:3:6 sub floor cement laid casting anti-termite concrete in position.
8 12 mm thick cement plaster
9 Dry brick
10 Earth filling
11 Sand layer
12 Floor finish

Fig 2



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Fire proofing

Objectives: At the end of this exercise you shall be able to
- **draw the fire proofing in circular column**
- **draw the fire proofing in square column**
- **draw the fire proofing in rectangular column with sectional channel**
- **draw the fire proofing in rectangular column with gypsum plaster board**
- **draw the fire proofing in square column with bricks.**

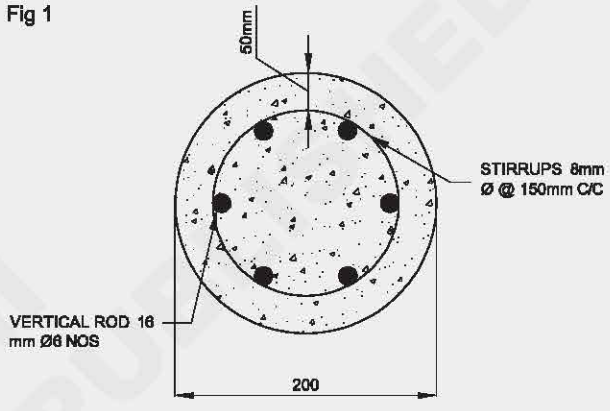
PROCEDURE

TASK 1 : **Draw the fire proofing in circular column as shown in Fig 1**

Data:

- Circular column size = 200 mm ϕ
- Dia of stirrups = 8 mm ϕ @ 150 mm c/c
- Dia of vertical rod = 16 mm ϕ 6 Nos.
- Concrete cover = 50 mm

Fig 1

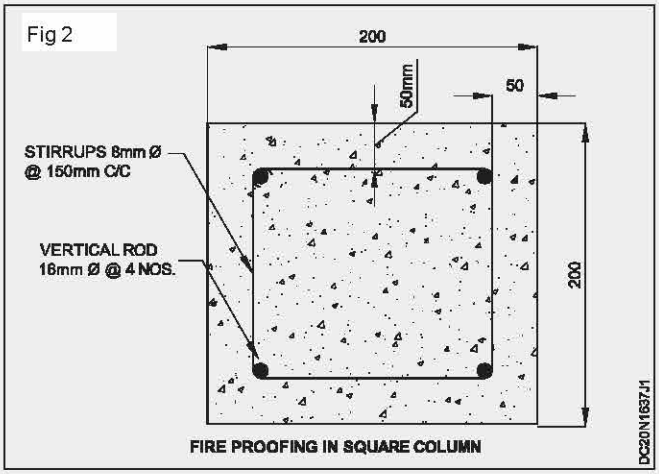


TASK 2 : **Draw the fire proofing in square column as shown in Fig 2**

Data:

- Square column size = 200 x 200 mm
- Dia of stirrups = 8mm @ 150 mm
- Dia of vertical rod = 16 mm ϕ @ 6 Nos.
- Concrete cover = 50 mm

Fig 2

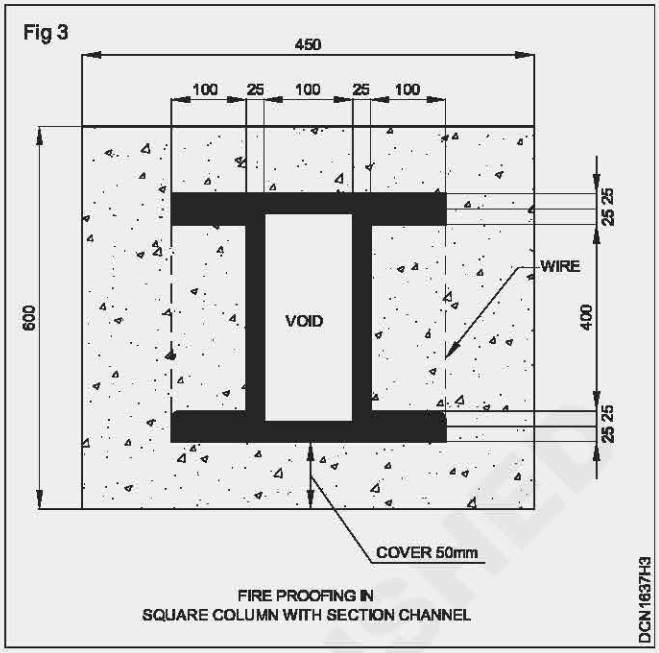


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TASK 3 : **Draw the fire proofing in rectangular column with channel sections as shown in Fig 3**

Data:

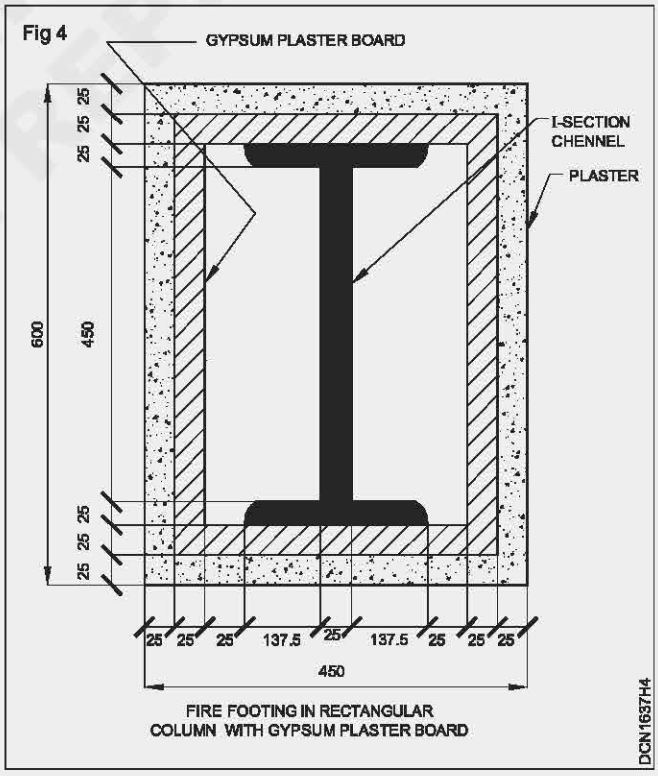
- Size of rectangular column with channel section = 450 x 600 mm
- Concrete cover = 50 mm



TASK 4 : **Draw the fire proofing in rectangular column with gypsum plaster board (Fig 4)**

Data:

- Size of rectangular column with gypsum plaster board = 450x 600 mm

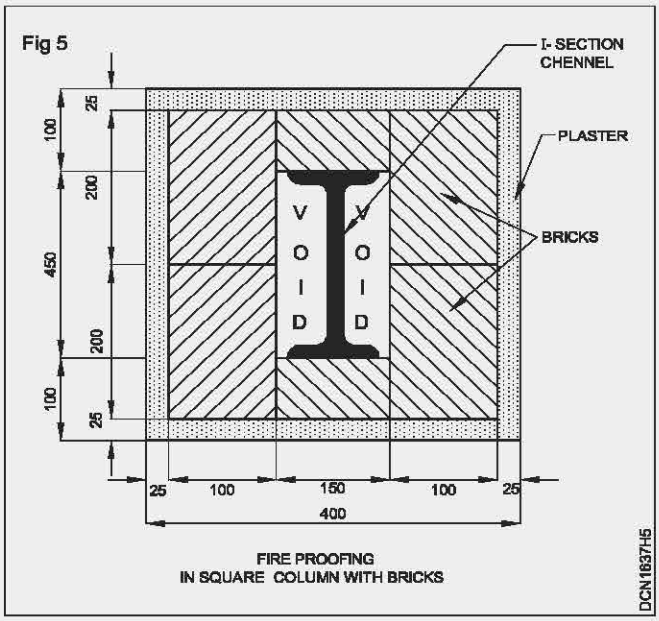


TASK 5 : **Draw the fire proofing in square column with bricks (Fig 5)**

Data:

- Size of bricks = 200 x 200 x100 mm

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Fire proofing

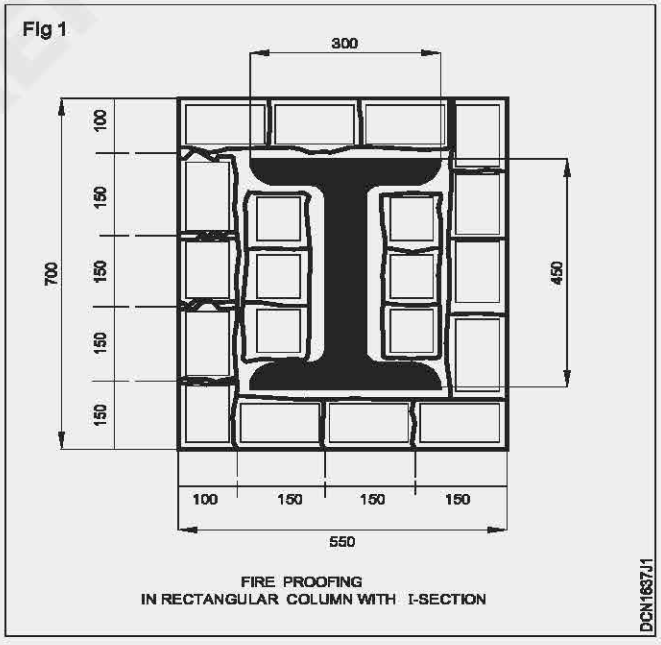
Objectives: At the end of this exercise you shall be able to

- **draw the fire proofing in rectangular column with I - Section**
- **draw the fire proofing in square column with section channel and gypsum tiles**
- **draw the fire proofing in rectangular column and formed slag blocks**
- **draw the fire proofing is jack arch floor**
- **draw the fire proofing in hollow tiled ribbed floor.**

TASK 1 : **Draw the fire proofing in rectangular column with I- Section as shown in Fig 1**

Data:

- Size of rectangular column = 550 x 700 mm
- Size of I - section channel = 300 x 450 mm (Thick = 25 mm)



TASK 2 : **Draw the fire proofing in square column with section channel and gypsum tiles as shown in Fig 2**

Data:

- Size of square column with section channel = 550 x 600 mm

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TASK 3 : **Draw the fire proofing in rectangular column and formed slag blocks as shown in Fig 3**

Data:

- Size of rectangular column and formed slag block = 550 x 700 mm
- Size of I - section chennel = 300 x 450 mm (Thick = 25mm)

TASK 4 :**Draw the fire proofing in jack arch floor as shown in Fig 4**

Data:

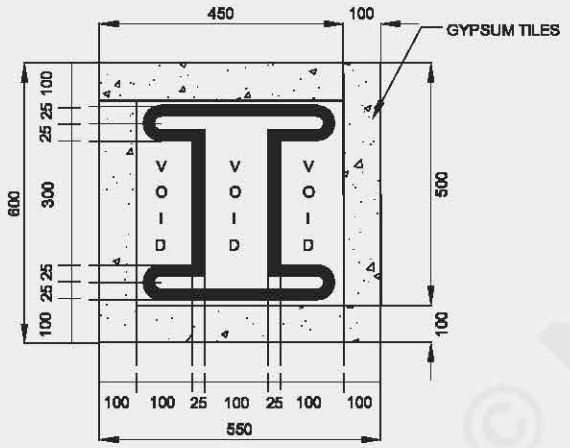
- Wall thickness = 40 cm
- Flooring thickness = 24 cm

TASK 5 :**Draw the fire proofing in hollow tiled ribbed floor as shown in Fig 5**

Data:

- Hollow tiled ribbed floor thickness = 350 mm

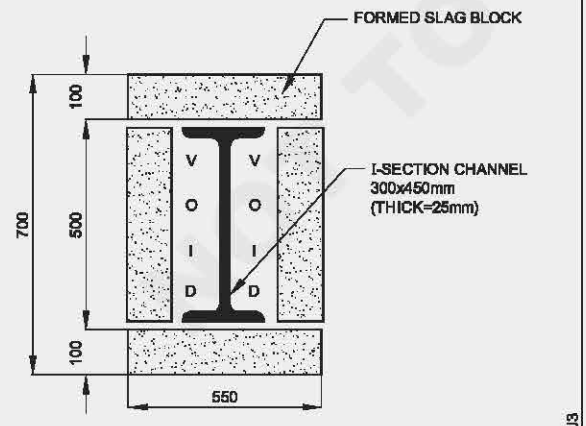
Fig 2



FIRE PROOFING IN SQUARE COLUMN WITH SECTION CHANNEL AND GYPSUM TILES

DCN1637J2

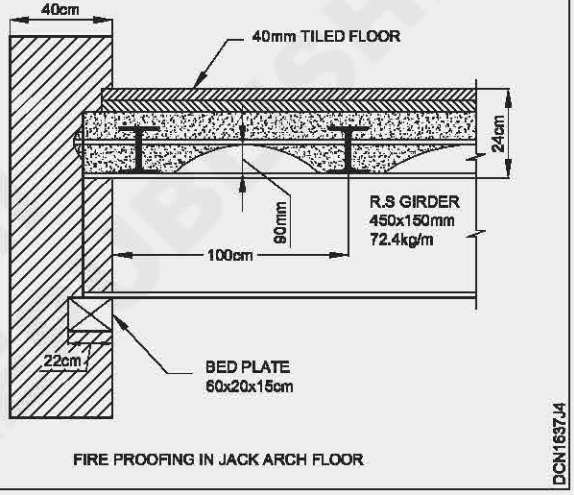
Fig 3



FIRE PROOFING RECTANGULAR COLUMN AND FORMED SLAG BLOCK

DCN1637J3

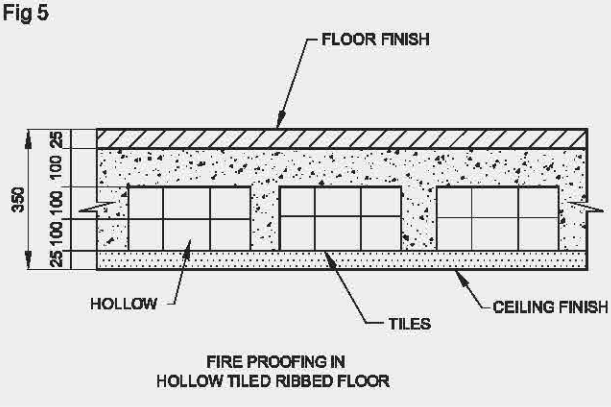
Fig 4



FIRE PROOFING IN JACK ARCH FLOOR

DCN1637J4

Fig 5



FIRE PROOFING IN HOLLOW TILED RIBBED FLOOR

DCN1637J5

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Type of arches

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

- **Draw the elevation of**
  - **flat arch**
  - **semicircular arch**
  - **segmental arch**
  - **elliptical arch three centered**
  - **elliptical arch five centered**
  - **two centered arch.**

PROCEDURE

TASK 1: **Draw the elevation of flat arch (Fig 1)**

Data:

Span = 1200mm

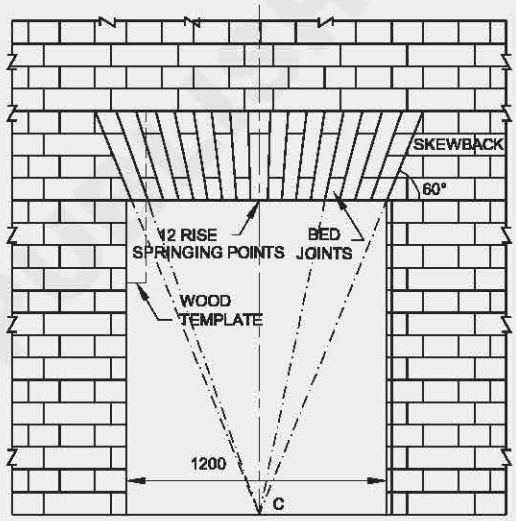
Depth = 300mm

Angle of skew back = 60°

Width of voussoir at extrados = 100mm

- Draw 1200 mm wide wall opening.
- Draw an equivalent triangle (between two supports) of side 1200mm as apex down ward.
- Draw 300 mm horizontal parallel line above, from the base of arch (extrados).
- Extent the other two sides of equivalent triangle to wards the extrados(skew back).
- Mark 100mm interval in extrados.
- Join the apex and 100mm interval points and arrange the bricks as shown in figure.

Fig 1



FLAT ARCH

TASK 2 : **Draw the elevation of semi circular arch (Fig 2)**

Data: Span = 800mm

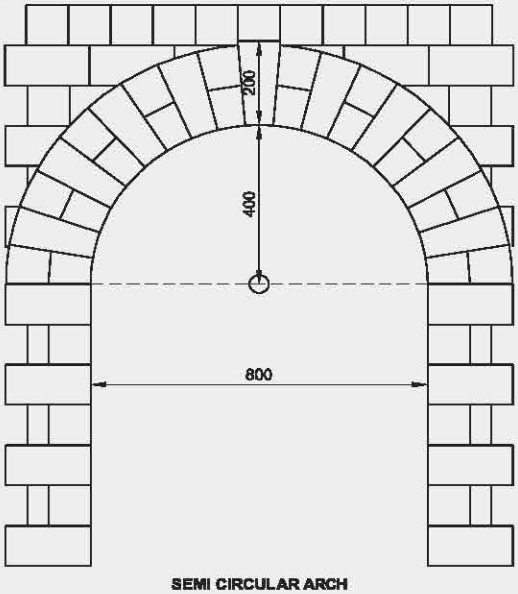
Depth = 200 mm

Rise = 400 mm

Width of voussoir at extrados = 100 mm

- Draw 800 mm wide wall opening.
- Draw the springing line.
- Midpoint of springing line as centre draw a semi circle (Intrados).
- From the same centre draw the extrados.
- Mark 100mm interval in extrados.
- Join the centre point of semi circle and 100 mm inter val points and arrange the bricks as shown in figure.

Fig 2



SEMI CIRCULAR ARCH

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TASL 3 : **Draw the elevation of segmental arch (Fig 3)**

Data:

Span = 800 mm

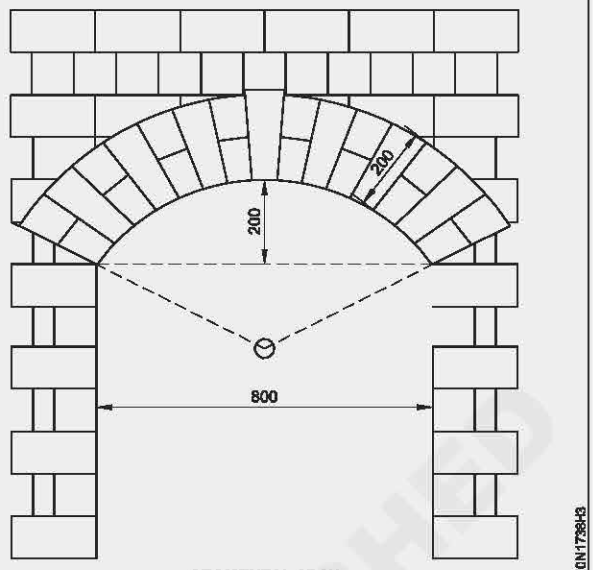
Depth = 200 mm

Rise = 200 mm

Width of voussoir at extrados = 100 mm

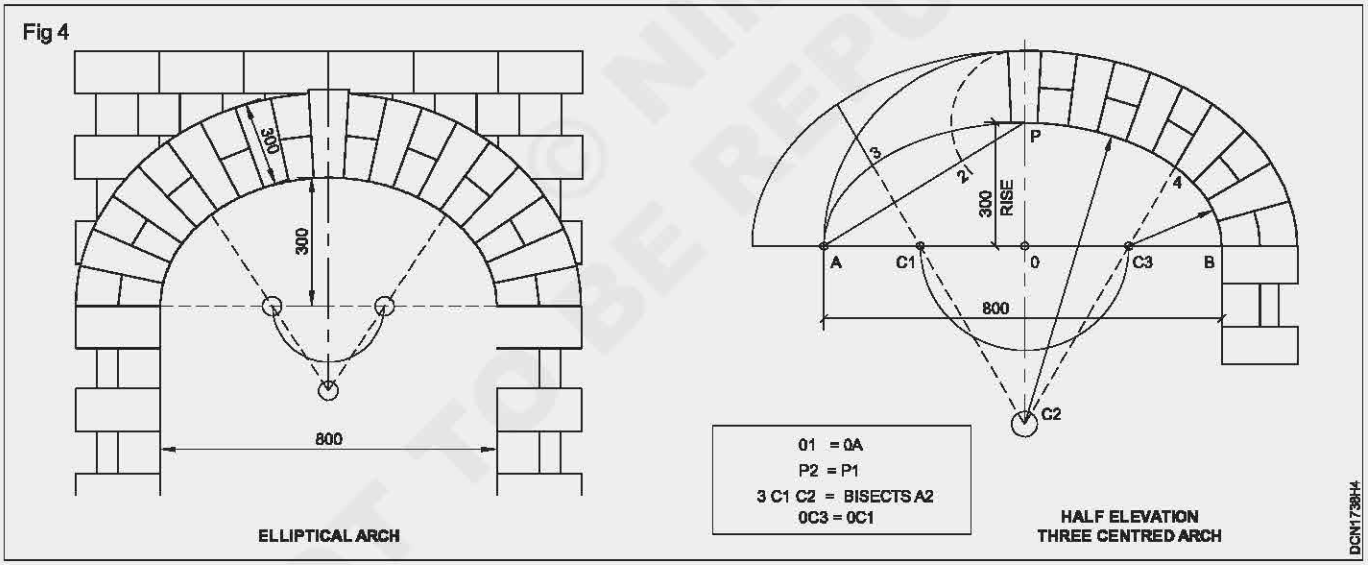
- Draw 800 mm wall opening.
- Draw the springing line.
- Draw the rise.
- Join the end of springing line and rise.
- Draw perpendicular to that inclined line.
- Repeat above 2 steps on other side.
- Joining point of the perpendiculars are the centre point of arch and draw the arc(intrados)
- Draw extrados.
- Mark 100mm interval in extrados.
- Join the centre point of semi-circle and 100 mm inter val points and arrange the bricks as shown in figure.

Fig 3



TASK 4 : **Draw the elevation of three centred arch (Fig 4)**

Fig 4



Data:

Span = 800 mm

Depth = 200 mm

Rise = 300 mm

Width of voussoir at extrados = 100 mm

- Draw span AB 800 mm and OP rise of the arch.
- Extend OP to 1 such that O -1 = OA.
- Join AP.
- Mark P-2 = P-1 by drawing an arc.
- Bisect A-2.
- Let the bisector of A-2 meet AB at C1 which is the centre of arch for the segment A-3.
- Extend the bisector to meet PO produced at C
- The point C2 is the centre for the segment 3P.
- The right hand side is symmetrical to the left hand side.
- By fixing C3 such that OC3 =OC1 all the three centres of the arch are fixed.
- Complete the arch by giving the thickness of the arch the extrados of the arch can draw from the same centres.
- Mark 100mm interval in extrados.

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- Join the centre point of semi circle and 100mm interval points and arrange the bricks as shown in figure.

TASK 5 : **Draw the elevation of five centered arch (Fig 5)**

Data:

Span = 800 mm

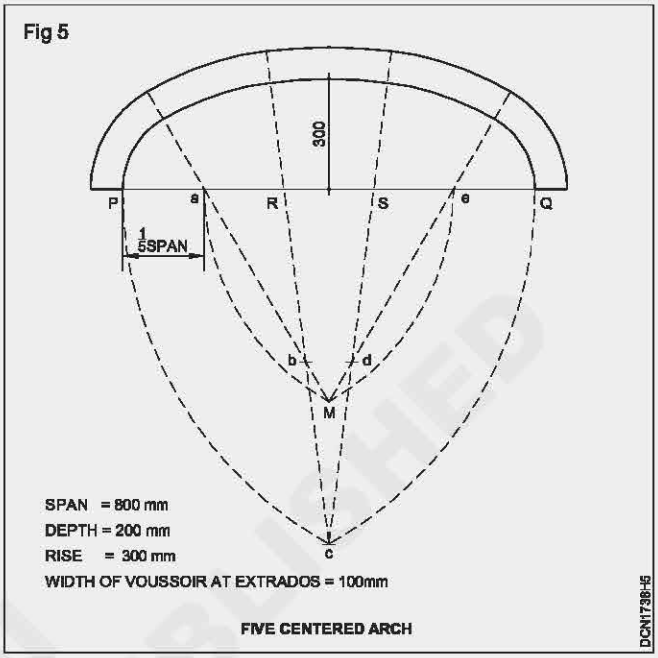
Depth = 200 mm

Rise = 300 mm

Width of voussoir at extrados = 100 mm

- Draw the springing line PQ and divide it into five equal parts as shown in figure.
- With centres as P and Q draw arcs of radius equal to the span, meeting each other at point C. Join point C with points R and S.
- With centres as A and E, draw arcs of radius equal to three divisions meeting each there at point M.

Fig 5



TASK 6 : **Draw the elevation of two centrered arch (Fig 6)**

Data:

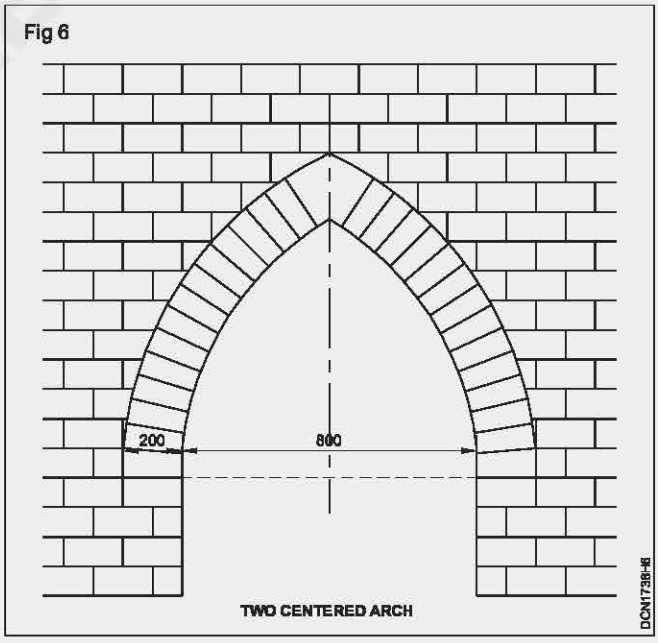
Span = 800 mm

Depth = 200 mm

Width of voussoir at extrados = 100 mm

- Draw 800 mm wide wall opening. Span AB = 800 mm.
- Draw an arc A as centre and AB as radius.
- Draw another arc B as centre BA as radius. Both arc will intersect at C.
- Draw arc from A and B as centers and radius = span + thickness of arch.
- Mark 100 mm at intrados draw the bricks.
- Complete the drawing as shown in figure.

Fig 6



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Drawing of lintels

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

- **Draw the elevation and section of**
  - **wooden lintel**
  - **stone lintel**
  - **brick lintel**
  - **rcc lintel**
  - **steel lintel**
  - **reinforced brick lintel.**

PROCEDURE

TASK 1: **Draw the elevation and section of wooden lintel (Fig 1)**

Data:

Span = 900 mm

Depth = 150 mm

Bearing = 150 mm

To draw elevation

- Draw the 900 mm wide wall opening
- Draw 1200 x 150 mm Lintel
- Draw the symbol of wood
- Draw the section line A-A
- Complete the drawing as shown in figure.

To draw section

- Draw the projection lines from elevation
- Complete the drawing with suitable symbols as shown in figure

— — — — — — — —

TASK 2: **Draw the elevation and section of brick lintel (Fig 2)**

Data: Span = 900 mm

Depth = 200 mm

Bearing = 150 mm

To draw elevation

- Draw the 900 mm wide wall opening
- Draw lintel of 1200 x 200 mm
- Draw the symbol of brick inside the rectangle
- Draw the section line A-A
- Complete the drawing as shown in figure.

To draw section

- Draw the projection lines from elevation
- Complete the drawing with suitable symbols as shown in figure

— — — — — — — — —

TASK 3 : **Draw the elevation and section of stone lintel (Fig 3)**

Data:

Span = 900 mm

Depth = 200 mm

Bearing = 150 mm

To draw elevation

- Draw the 900mm wide wall opening
- Draw lintel 1200 x 200mm
- Draw the symbol of stone
- Draw the section line A-A
- Complete the drawing as shown in figure.

To draw section

- Draw the projection lines from elevation
- Complete the drawing with suitable symbols as shown in figure

— — — — — — — — —

TASK 4: **Draw the elevation and section of steel lintel (Fig 4)**

Data:

Span = 1200 mm

Depth = 150 mm

Bearing = 150 mm

To draw elevation

- Draw the 1200 mm wide wall opening

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- Draw lintel of size 1200 x 150 mm
- Draw the symbol of steel
- Draw the section line A-A
- Complete the drawing as shown in figure.

To draw section

- Draw the projection lines from elevation
- Draw sectional view of steel beam
- Complete the drawing with suitable symbols as shown in figure

Fig 1

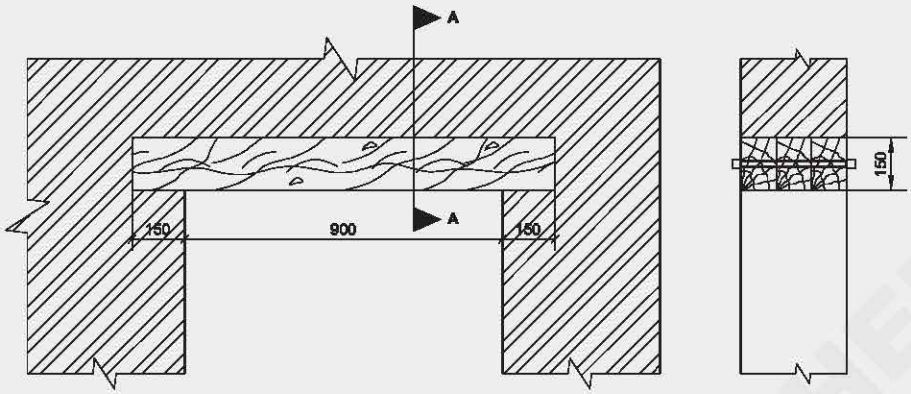


Fig 1 WOOD LINTEL

Fig 2

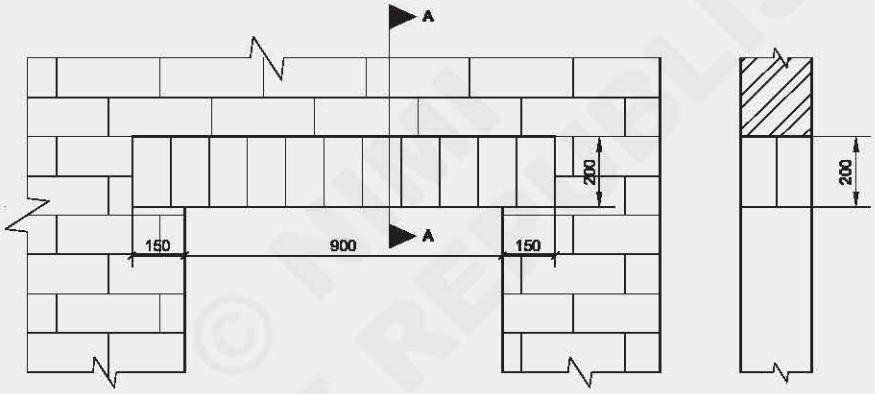


Fig 2 BRICK LINTEL

Fig 3

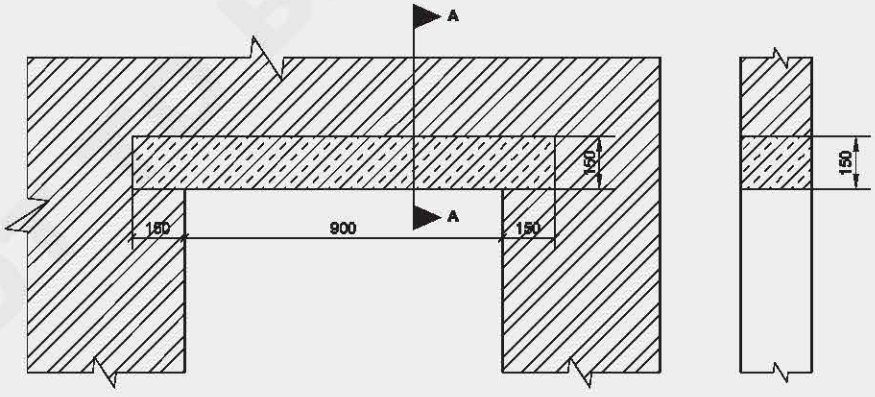


Fig 3 STONE LINTEL

DCN173801

TASK 5 : **Draw the elevation and section of rcc lintel (Fig 5)**

Data:

Span = 900 mm

Depth = 150 mm

Bearing= 150 mm

Diameter of main bars = 12 mm

Diameter of stirrups = 6 mm

Cover for reinforcement = 25 mm

To draw elevation

- Draw the 1200 mm wide wall opening
- Draw lintel 1200 x 150 mm
- Draw the straight bar at bottom and top level of 12 mm dia at 25 mm cover
- Crank the bar at one seventh of the span on 45°
- Draw the stirrups of 6 mm dia at 150 mm c/c
- Draw the symbol of RCC inside
- Draw the section line A-A
- Complete the drawing as shown in figure.

To draw section

- Draw the projection lines from elevation
- Draw the rectangle of size 200x150 mm
- Draw the stirrups details with 25 mm cover
- Complete the drawing with suitable symbols as shown in figure

Fig 4

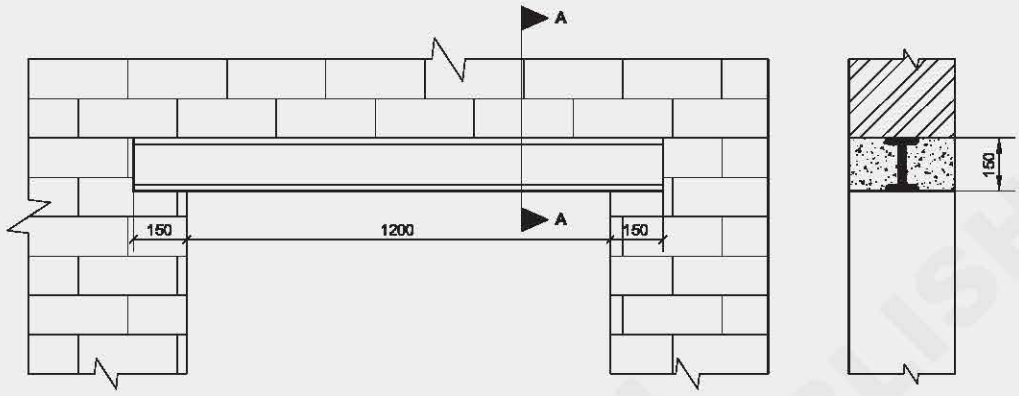


Fig 4 STEEL LINTEL

Fig 5

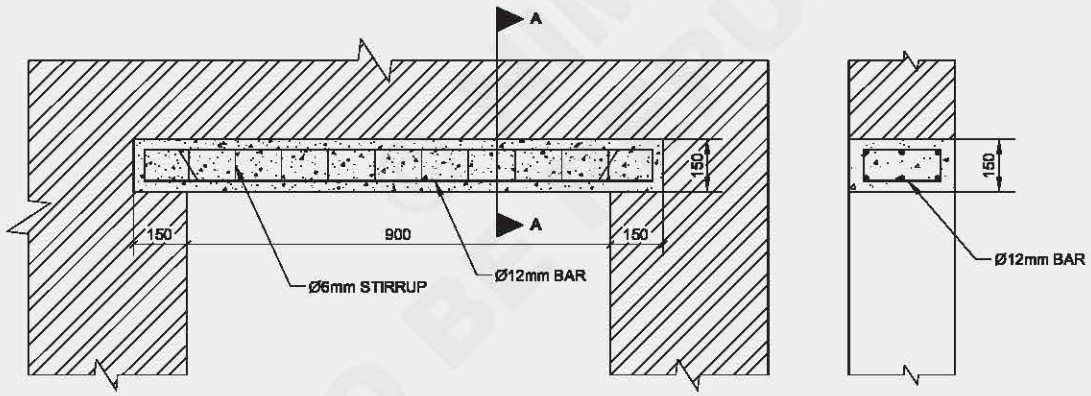


Fig 5 R.C.C LINTEL

Fig 6

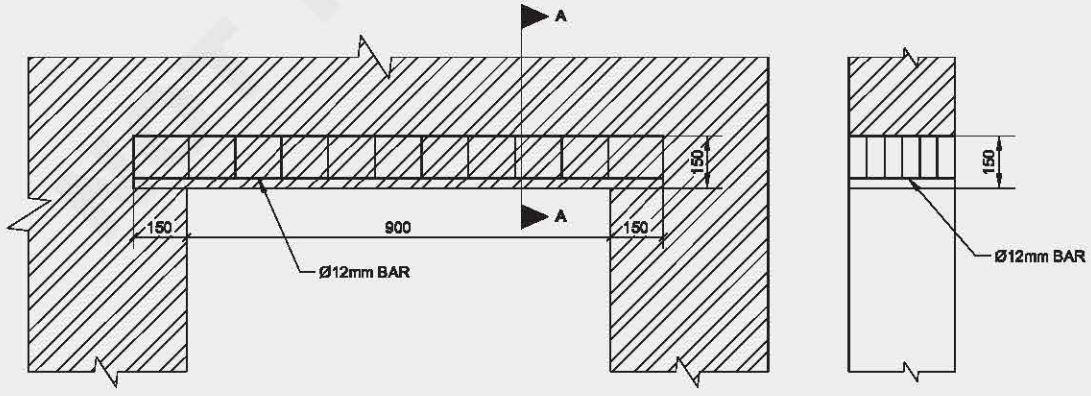


Fig 6 REINFORCED BRICK LINTEL

DGN1739D4

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TASK 6 : **Draw the elevation and section of reinforced brick lintel (Fig 6)**

Data:

Span = 900 mm

Depth = 200 mm

Bearing = 100 mm

Diameter of reinforcement = 12 mm

To draw elevation

- Draw the 1200 mm wide wall opening
- Draw lintel 1200 x 200 mm
- Draw the elevation of bricks as header inside
- Show the reinforcement by dashed line with required cover
- Draw the section line A-A
- Complete the drawing as shown in figure.

To draw section

- Draw the projection lines from elevation
- Draw the rectangle of size 200 x 150 mm
- Draw the stirrups details with 25 mm cover.Complete the drawing with suitable symbols as shown in figure

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Drawing of lintel with chajjah (or) sunshade

Objectives: At the end of this exercise you shall be able to
- **draw the cross section of lintel with chajjah (or) sunshade.**

PROCEDURE

TASK 1: **Draw the cross section of lintel with chajjah (or) sunshade shown in Fig**

Data:

- All side cover = 2.5 cm
- Projection of sunshade = 60 cm
- Width of wall = 20 cm
- Height of lintel = 20 cm
- Fixing end of sunshade thickness = 10 cm
- Free end of sunshade thickness = 8 cm

Lintel

- 2 Bar (top) 10 mm ϕ
- 3 Bar (bottom) 10 mm ϕ
- Stirrups (15 cm c/c) 6 mm ϕ

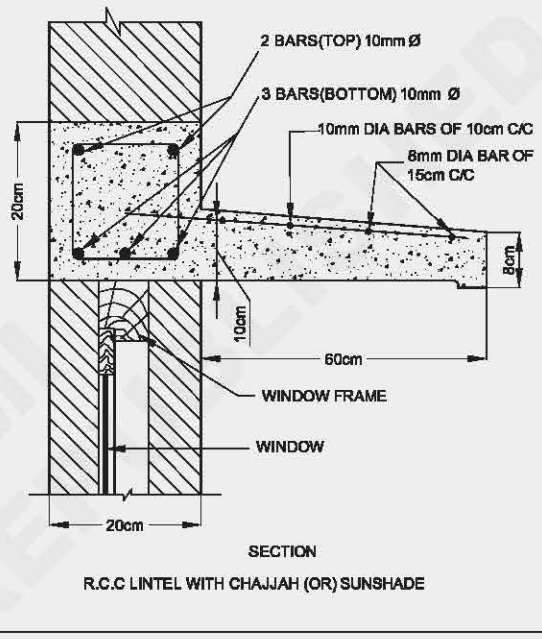
Chajjah

- 10 mm ϕ bar of 10 cm c/c
- 8 mm ϕ bar of 15 cm c/c+

To draw sectional view

- Draw the 20 cm wide wall.
- Draw the 20 cm cross section of lintel
- Draw the 10 cm cross section of window
- Draw the symbol of brick of wall

Fig 1



- Draw the 60 cm projection of chajjah (Fixed end = 10 cm, free end 8 cm)
- Mark the concrete symbol of lintel with chajjah.
- Complete the drawing as shown in Fig.
- Show the details of reinforcement of the drawing.

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Equipment and instrument used to perform surveying

Objectives : At the end of this exercise you shall be able to
- **identify the names of the surveying instrument**
- **identify the surveying equipments.**

PROCEDURE

TASK 1 : **Write the names of the surveying instruments in Table 1.**

Table 1

S.No	Name of the instrument
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Fig 1

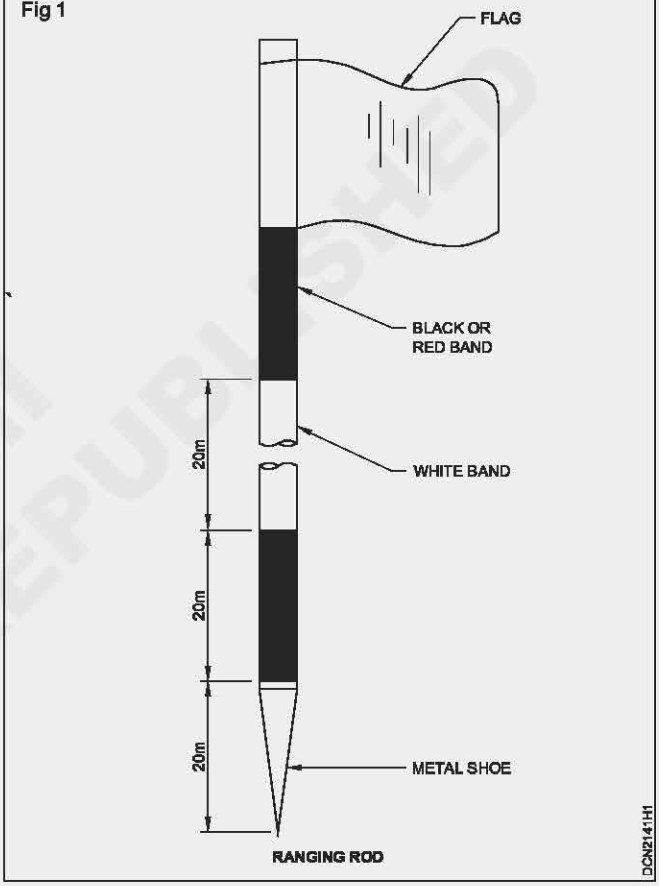


Fig 2

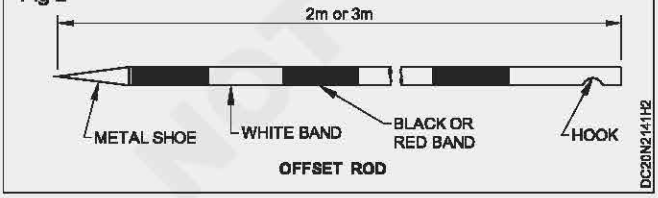


Fig 3

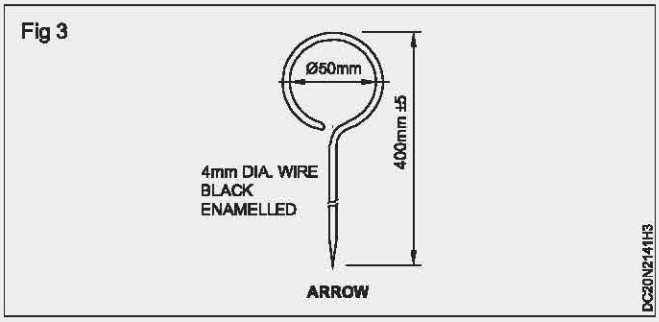
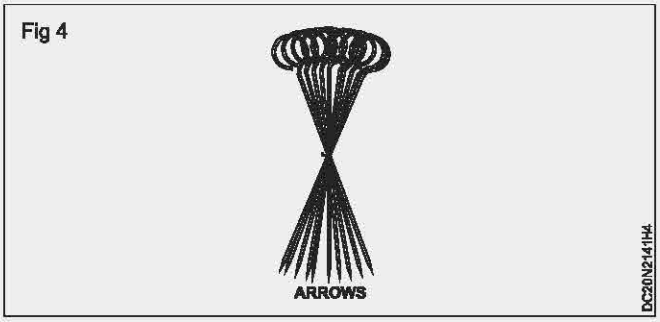
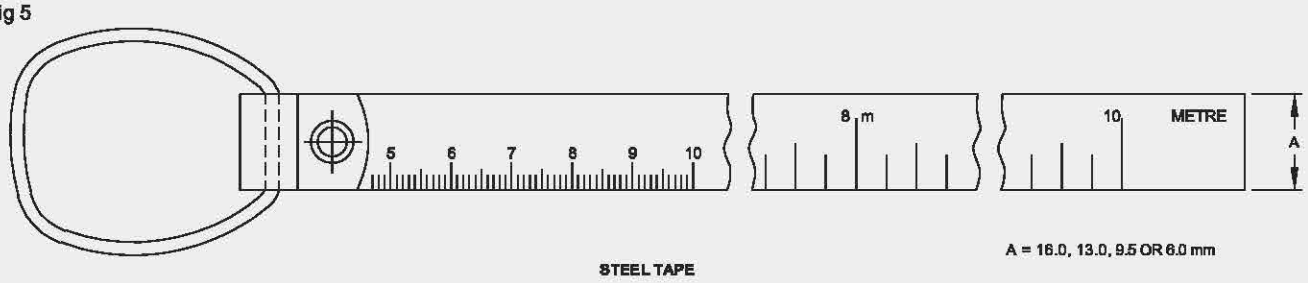


Fig 4



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Fig 5

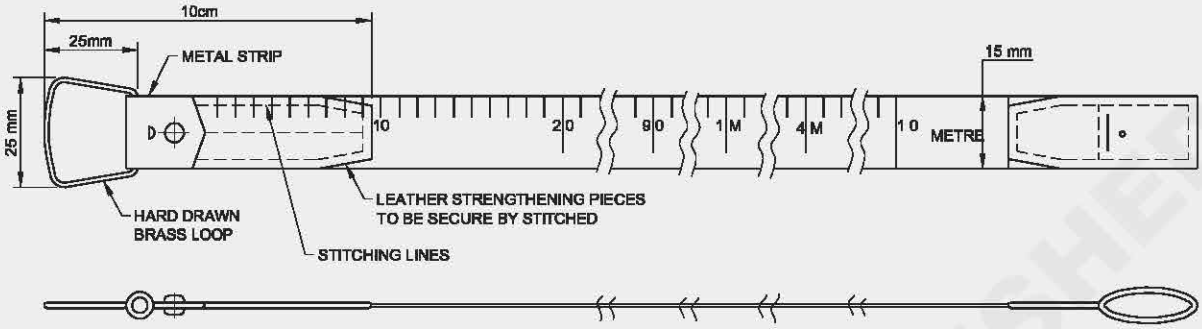


A = 16.0, 13.0, 9.5 OR 6.0 mm

STEEL TAPE

DCN2141H5

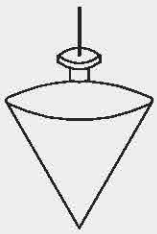
Fig 6



METALLIC TAPE

DCN2141H8

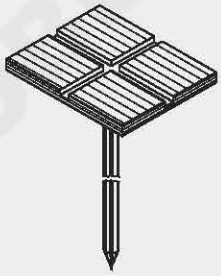
Fig 7



PLUMB BOB

DC20N2141H7

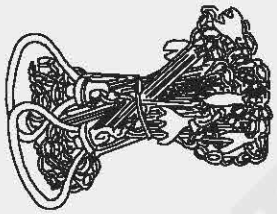
Fig 10



WOODEN CROSS STAFF

DC20N2141HA

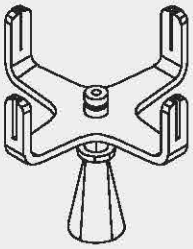
Fig 8



FOLDING OF CHAIN

DC20N2141H8

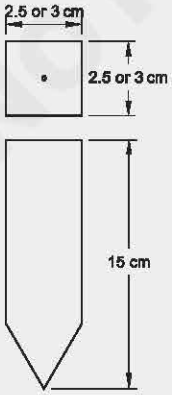
Fig 11



METAL ARM CROSS-STAFF

DC20N2141H8

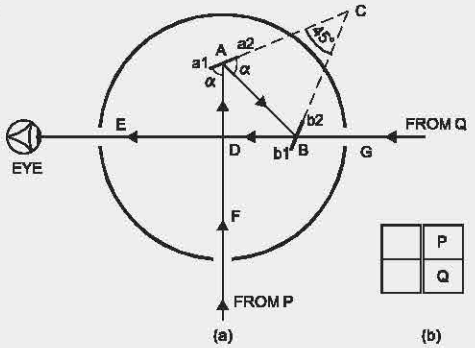
Fig 9



WOODEN PEG

DC20N2141H9

Fig 12

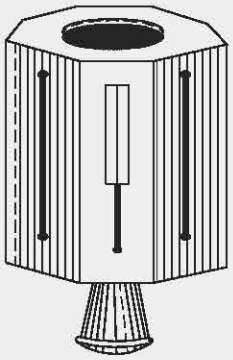


OPTICAL SQUARE

DCN2141H0

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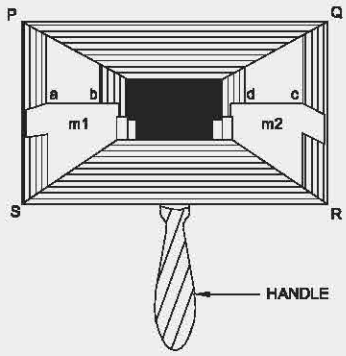
Fig 13



FRENCH CROSS-STAFF

DC20N2141HD

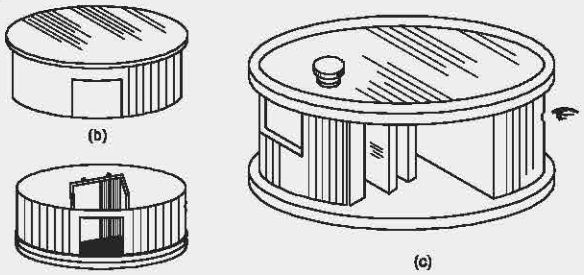
Fig 15



INDIAN OPTICAL SQUARE

DCN2141HF

Fig 14



ROUND OR CYLINDERICAL OPTICAL SQUARE

DCN2141HE

TASK 2: **Write the name of the equipments used in surveying in Table 2**

Table 2

S.No	Name of the instrument
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Fig 2

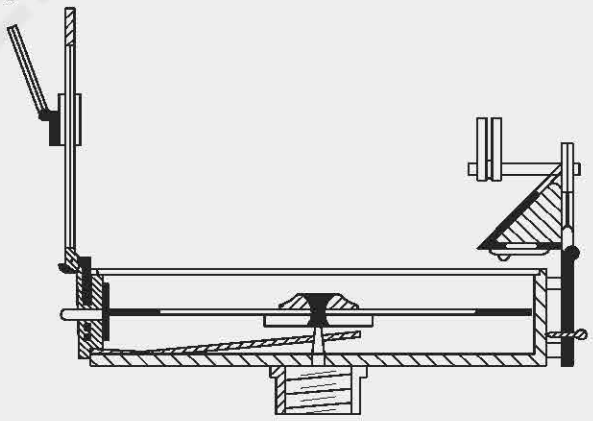


FIGURE SHOWING POSITION 2

DCN2141X2

Fig 3

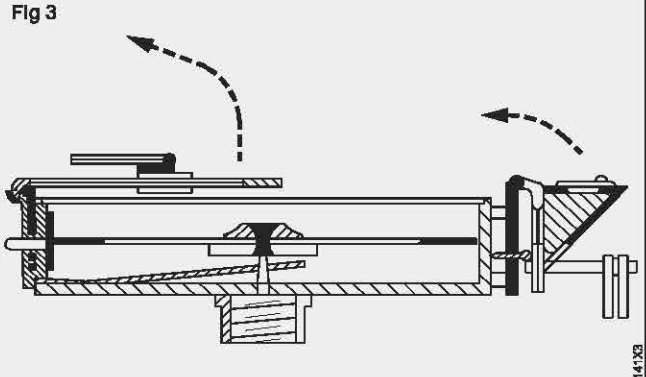


FIGURE SHOWING POSITION 1

DCN2141X3

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Fig 1

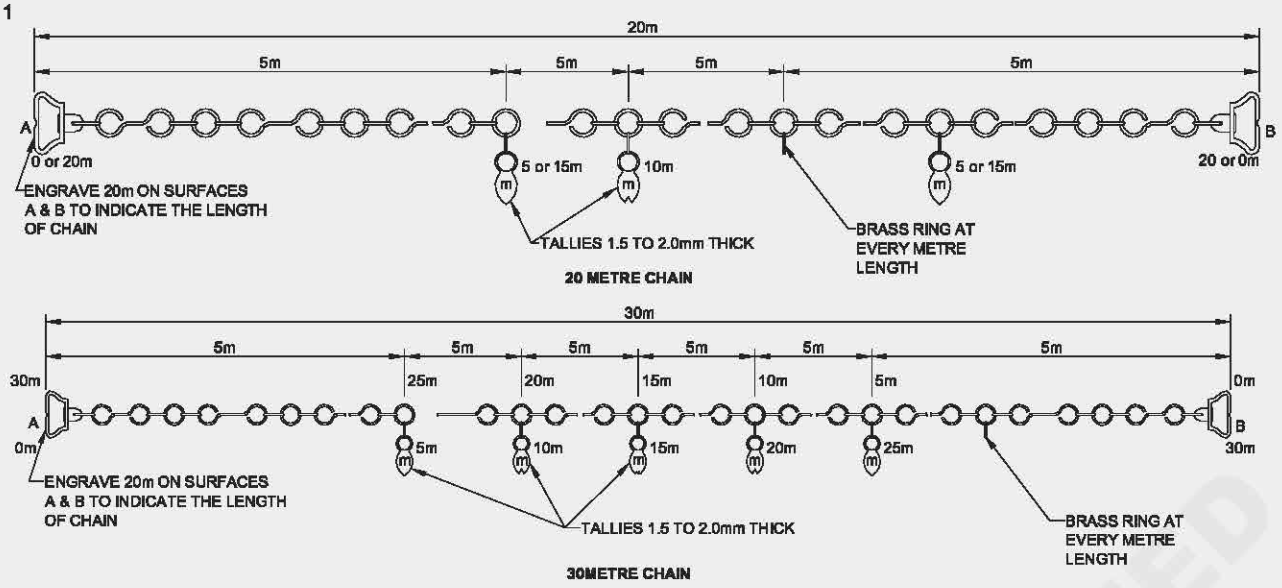


Fig 4

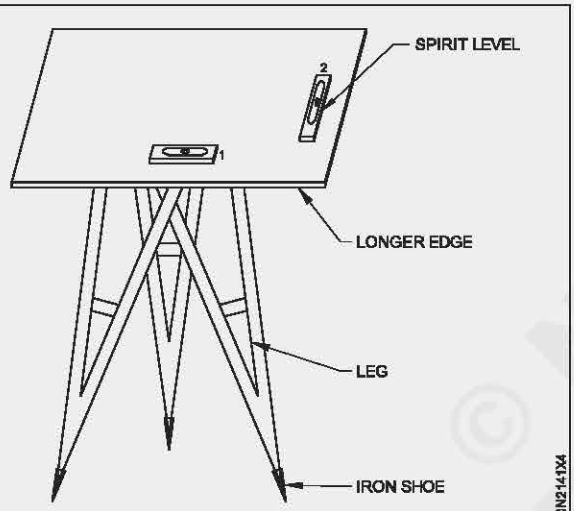


Fig 5

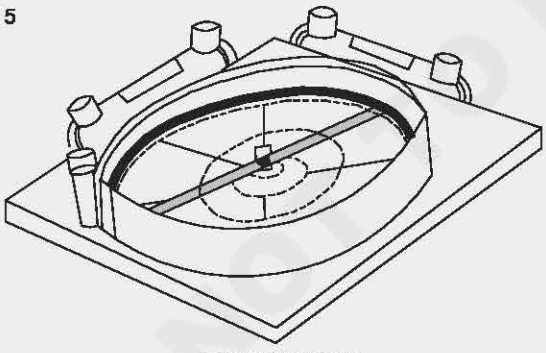


Fig 6

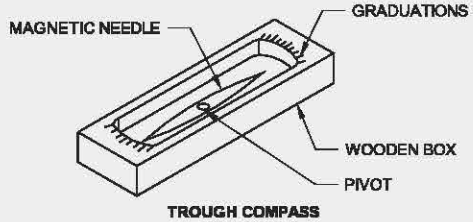


Fig 7

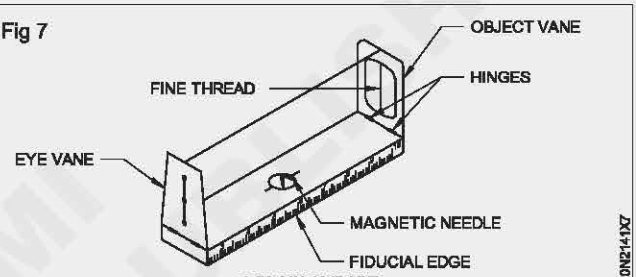


Fig 8

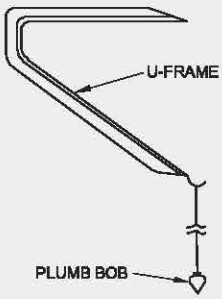
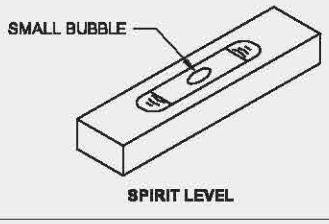
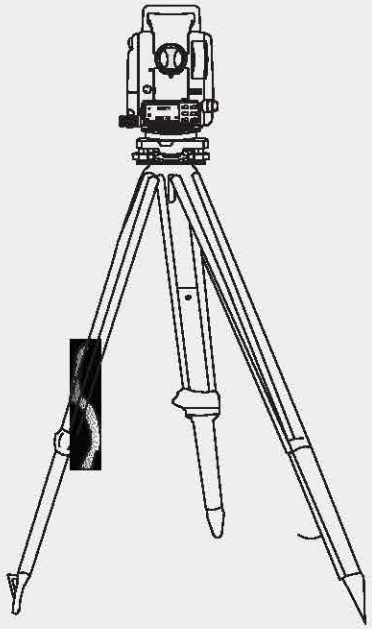


Fig 9



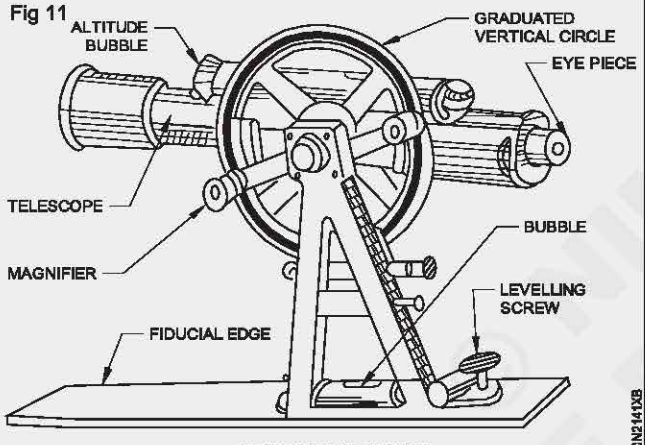
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Fig 10



DCN2141XA

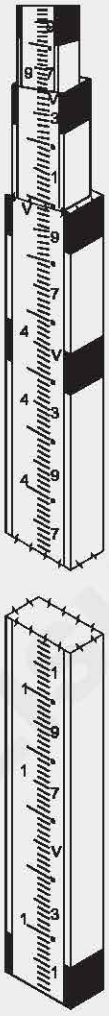
Fig 11



A TELESCOPIC ALIDADE

DC20N2141XB

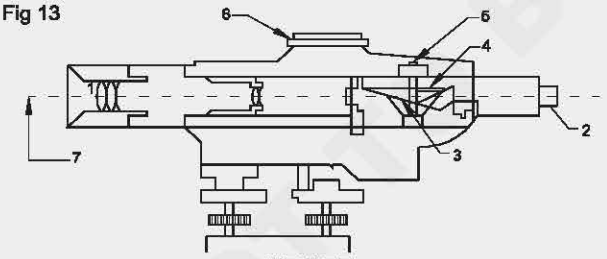
Fig 12



TELESCOPIC STAFF

DCN2141XC

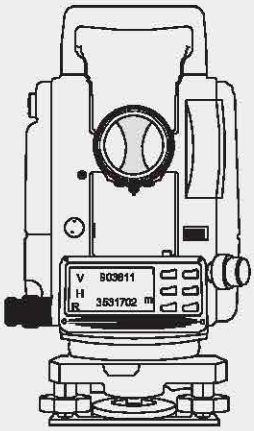
Fig 13



AUTO LEVEL

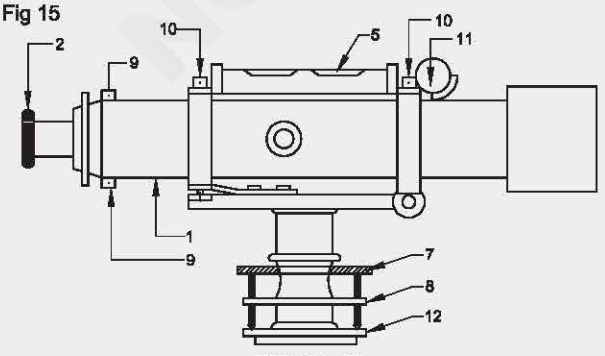
DC20N2141XD

Fig 14



DC20N2141XE

Fig 15



DUMPY LEVEL

DC20N2141XF

NOT TO BE REPUBLISHED

Distance measuring with chain and tape

Objectives : At the end of this exercise you shall be able to
- **measure the distance between two given points within 30m/20m**
- **measure the distance if it exceeds by one chain length**
- **measure the distance between two given points by using 15m/30m steel tape.**

Requirement

Tools/Instruments

• Chain 20m/30m	- 1 No.
• Steel tape 15m/30m	- 1 No.
• Metallic tape 15m/30m	- 1 No.
• Ranging rod 2/3m-3cmf	- 3 Nos.
• Arrows 40cm long	- 10 Nos.

PROCEDURE

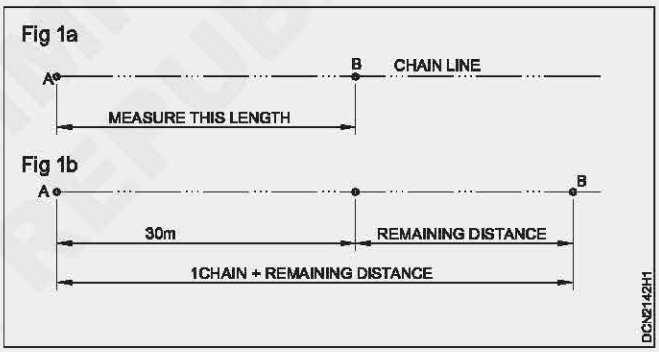
TASK 1: **Measure the distance between two given points within 30m/20m by using 30m/20m chain**

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 inline with AB.

3 Count the tallies and links from A to B.

4 This is the distance between A and B (Fig 1a).



— — — — — — — —

TASK 2: **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).

— — — — — — — —

Task 3: **Measure the distance between two given points by using 15m/30m steel tape**

Case (a)

If the distance is within 15m/30m length

– Select two points A,B.

– Unwind the tape, hold the zero point (Ring) at A.

– Pull the tape until to reach B.

– Read the measurements on tape.

Case (b)

If the distance exceeds one tape length 15m/30m

– Mark the 15m/30m on the line.

– Measure the remaining length from this point and add.

Booking in the field book

Entering all the readings with respect to figure in the field book.

— — — — — — — —

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Entering field book and plotting

Objectives: At the end of this exercise you shall be able to
- **entering single line field book**
- **entering double line field book**
- **survey and plot your ITI with chain.**

Requirement

Tools / Instruments

• Metric chain 30m	- 1 No.
• Arrows 40cm	- 10 Nos.
• Ranging rods 2.3m	- 8 Nos
• Cross staff	- 1 No.
• Junior Drafter	- 1 No.
• Pegs	- as reqd.
• Metallaic tape 30 m length	- 1 No.
• Nails	- as reqd.

Materials

• Drawing sheet A3	- 1 No.
• Single line field book	- 1 No.
• Double line field book	- 1 No.
• Pencil HP	- 1 No.
• Eraser	- 1 No.
• Set of scale	- 1 set.
• Cello tape	- 1 roll.

PROCEDURE

TASK 1: **Entering single line & 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 moved upwards.

7 Record each chain line or tie line in a separate page.

8 The record should move inforward direction of chaining.

9 All measurements should be recorded immediately.

10 If the entire page is dis regarded 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.

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 commercement inside the Δ.

16 Close inside the Δ.

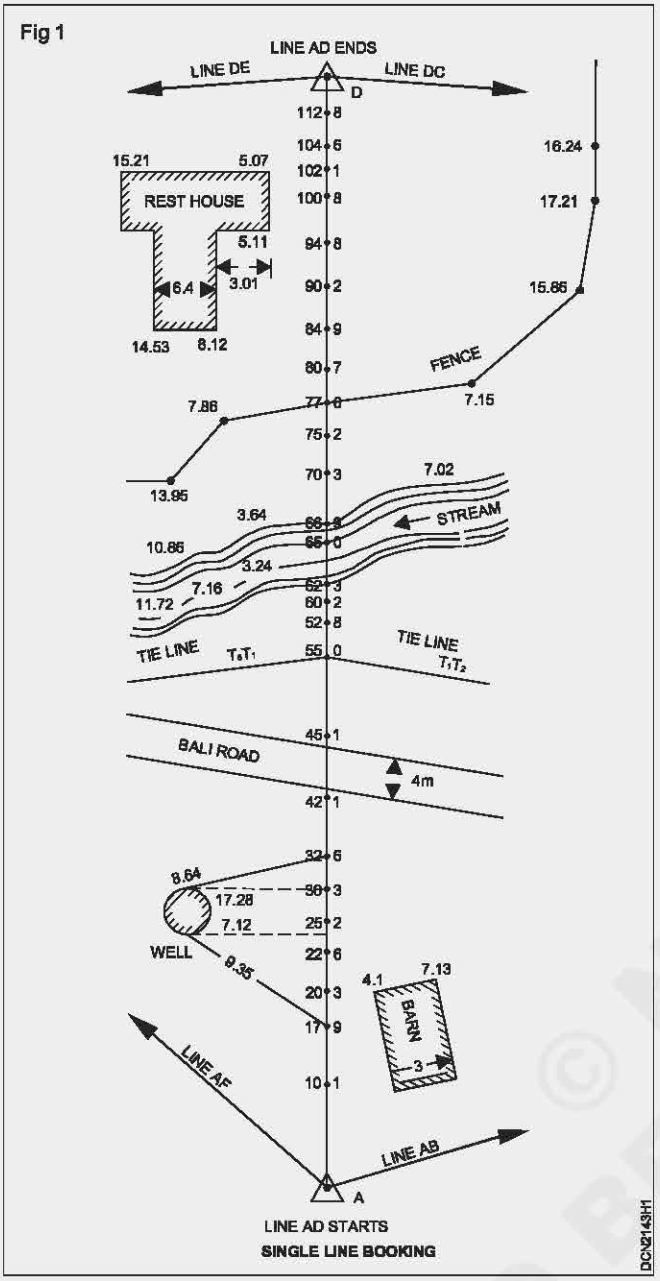
17 Mark the subsidiary stations by means of circle or ○ as oval.

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 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.
- 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.

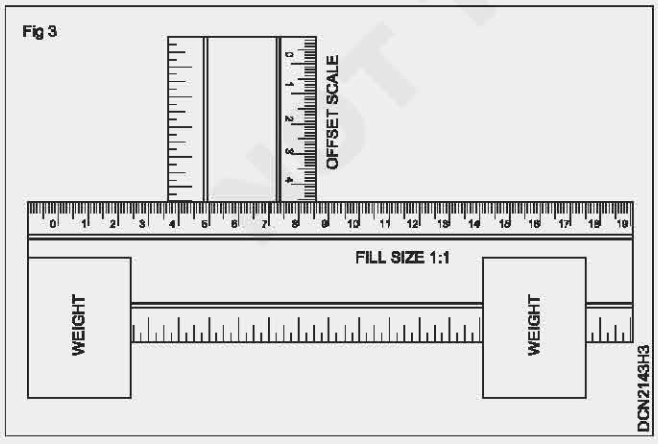
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Fig 1



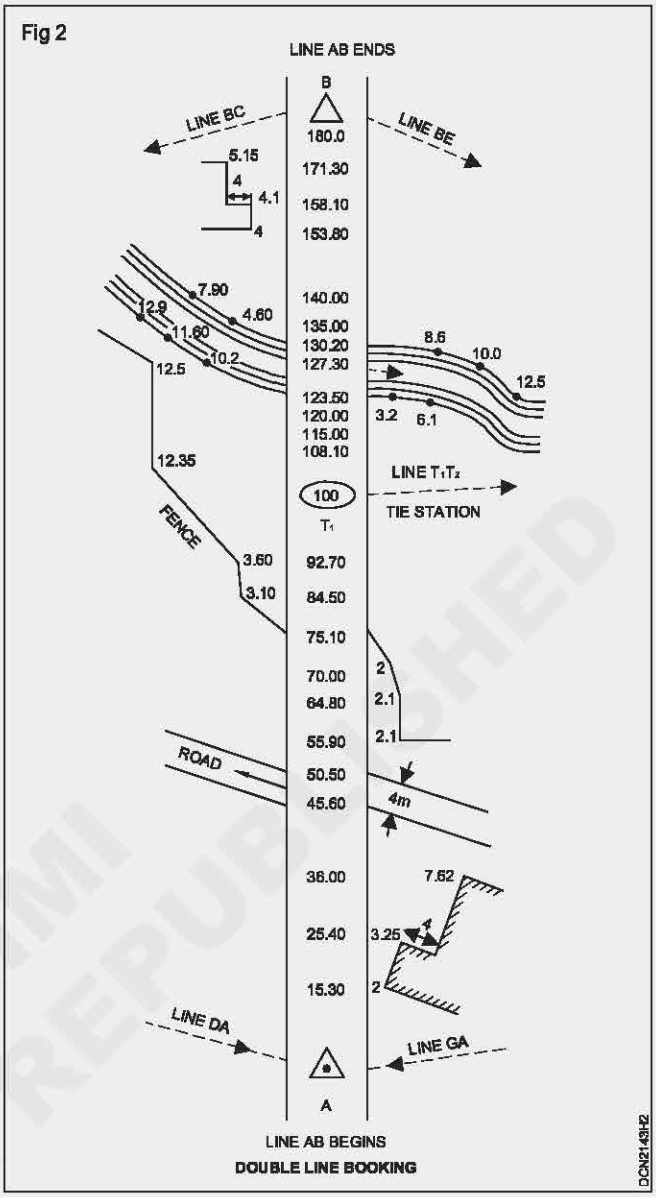
Offset scale (Fig. 3): Using of offset scale for plotting perpendicular offset

Fig 3



- Put the long scale along the chain line, with its zero mark is exactly at the starting point of the line.

Fig 2



- 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.

Conventional signs & Symbols

The earth surface contains varieties of natural and artificial features. If it is to be shown graphically, it will not be possible without its description. To overcome this difficulty standard symbols have been adopted for each type of details.

The symbols which are drawn to natural or artificial details on a map is known as convetional signs.

Various signs used in Surveying are as follows. (Table 1)

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TASK 3: **Survey and plot your ITI with chain**

Fig 4 shows the model site of the exercise.

Field work

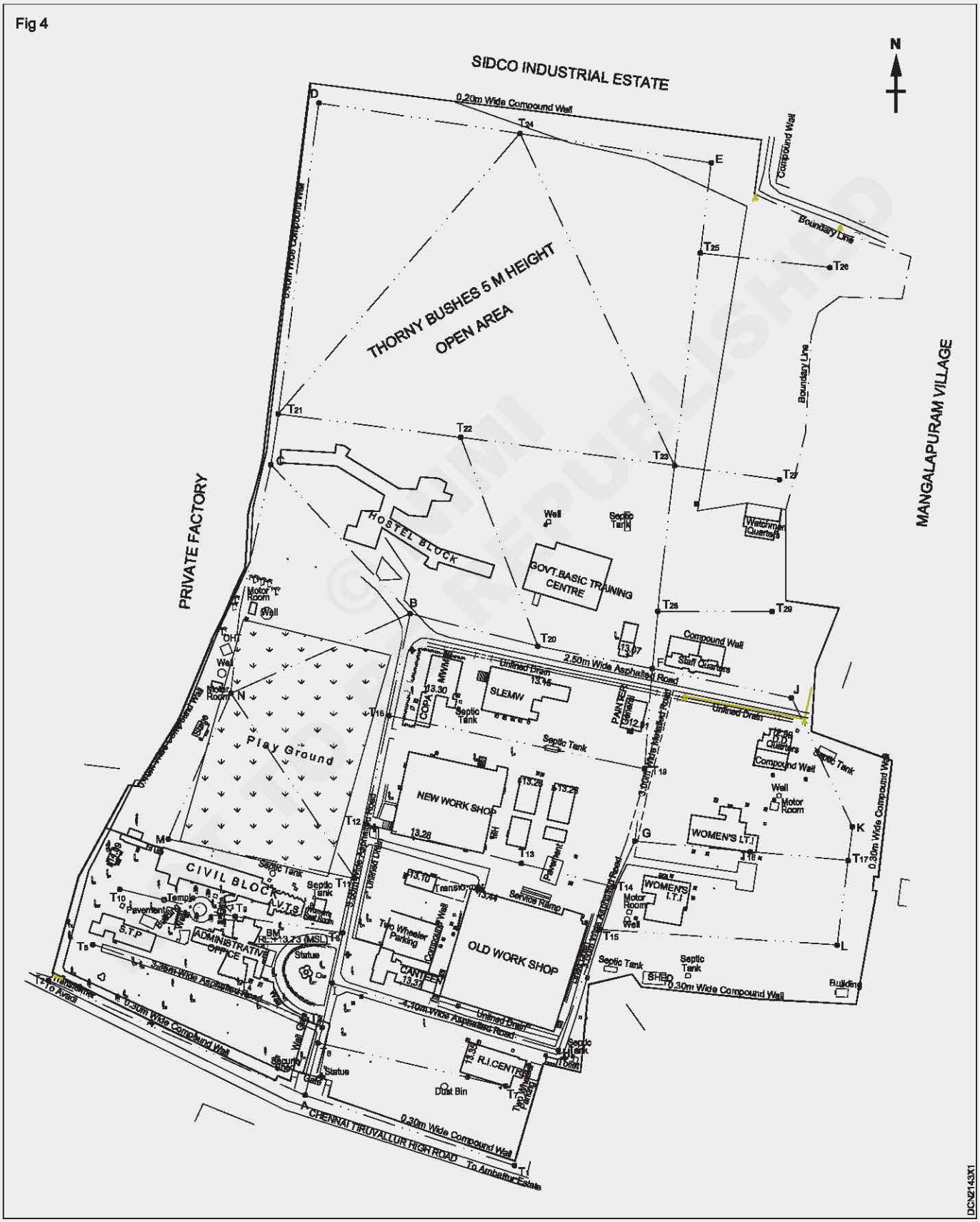
1 Make reconnaissance survey prepare rough sketch of the given site in the field book.

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 5)

4 Select the check line BC, BN, NT etc.

Fig 4



5 Select the tie stations T_1, T_2 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 chainlines 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 .

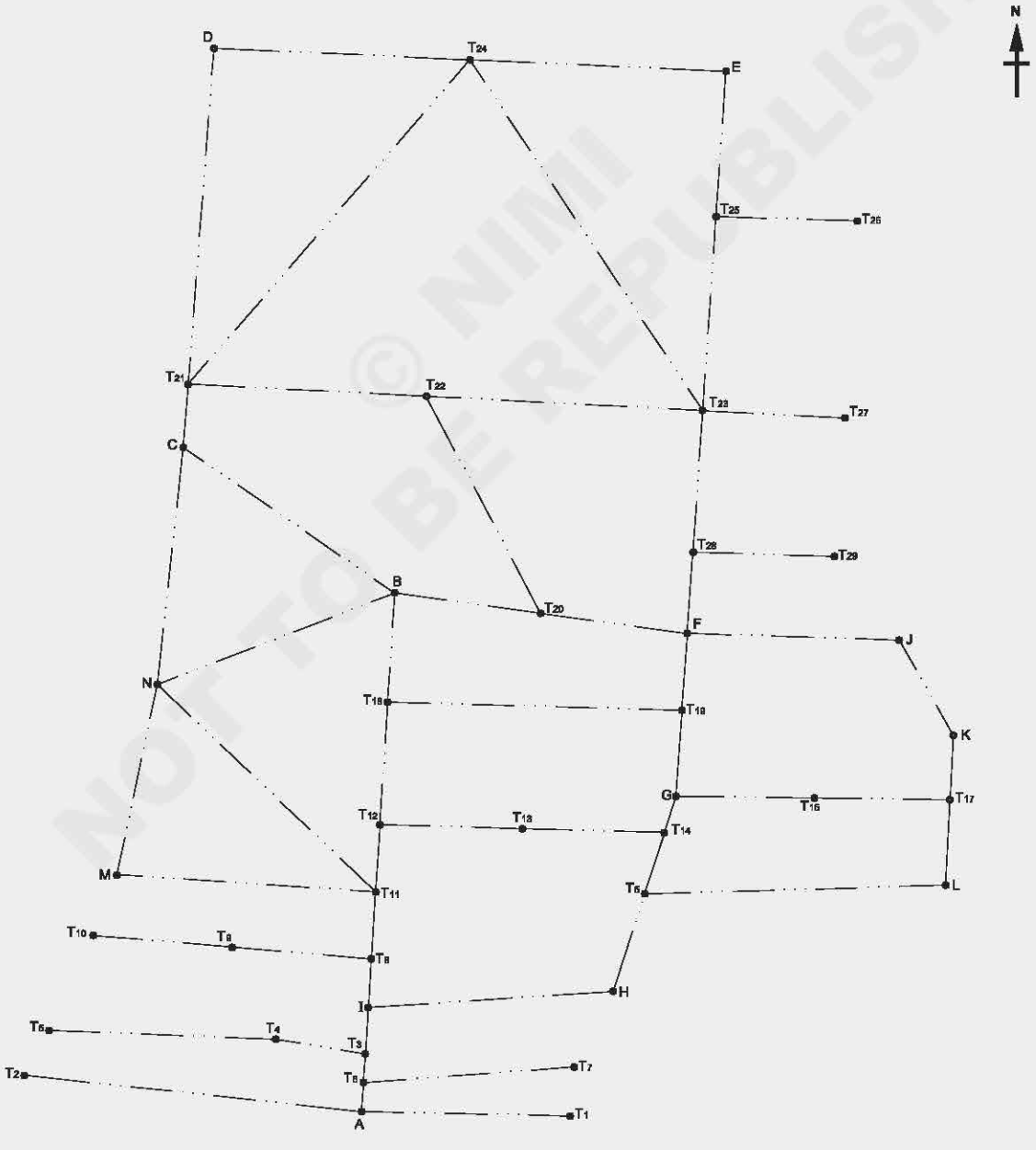
11 Mark the north direction its right top corner of the drawing sheet.

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 5



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Calculating the area of the site

Objectives: At the end of this exercise you shall be able to
- **calculate the area of the polygonal shaped land**
- **calculate the same by planimeter**
- **calculate the areas of an irregular field**
- **apply geometrical formulae for calculating the area**
- **describe the construction and use of planimeter.**

Requirement

Tools/Instruments

• Metric chain 30mm	- 1 No.
• Arrows 40cm long	- 10 Nos.
• Ranging rods 2/3m	- 6 Nos.
• Cross staff	- 1 Nos.
• Junior drafter	- 1 Nos.

Materials

• Drawing sheet A3	- 1 No.
• Field note book	- 1 No.
• Pencil HB	- 1 No.
• Eraser	- 1 No.
• Set of scale	- One set.
• Cello tape	- 1 roll.

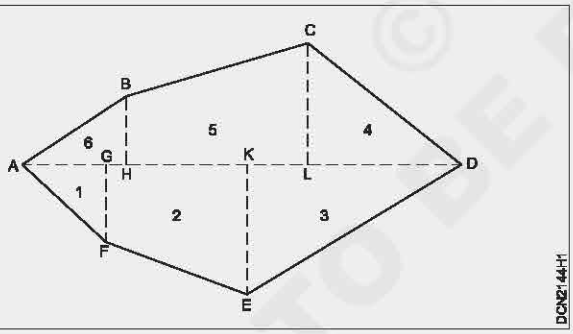
PROCEDURE

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 chainline 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)

— — — — — — — —

TASK 2: **Application of geometrical formulae for calculating the area**

Now apply the geometrical formulae for calculating the according to the shape of the figures. (Fig 2)

1 Area of triangle

½ x base x height

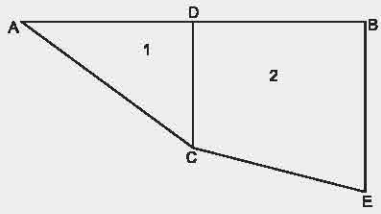
2 Area of trapezium

base (a+b)/2 x height

Plot the following details of a field and calculate its area all measurements are in metres. (Fig 3)

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Fig 2



Serial No. 1 In DABG

Chainage in metres 0 and 20m.

Offsets in metres 0 and 36m.

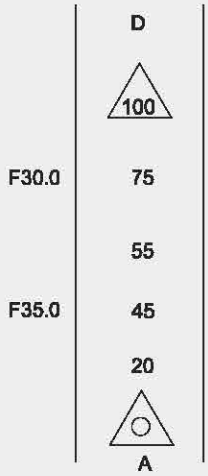
In Δ ABG

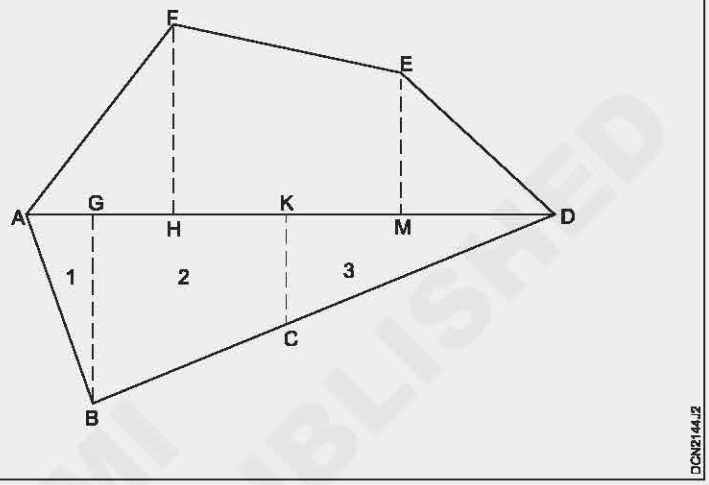
Area = ½ x base x height

=1/2 x 20 x 36

=360 sq.m.

Fig 3





Area of trapezium GBCK

Chainage in metres = 2m and 55m = 35m.

Offsets in metres 36m and 20m = 28m.

=35 x 28 = 980 sq.m.

Sl. No. 3

Area of triangle KCD

=45m x 10m = 450 Sq.m.

Sl. No. 4

Area of triangle DME = 25 x 15 = 375 sq.m.

Sl. No. 5

Area of Trapezium = 30 x 32.50m= 975.00 sq.m.

Sl. No. 6

Area of triangle AHF = 45 x 17.50 = 787.50 sq.m.

S. No.	Figure	Change in metres	Base in Metres	Offsets in metres	Mean offsets in metres	Area in square Metres		Remarks
						+ve	-ve	
1	2	3	4	5	6	7	8	9
1	ΔABG	0 and 20	20	0 and 36	18	360.00	-	
2	Trapezium GBCK	20 and 55	35	36 and 20	28	980.00	-	
3	ΔKCD	55 and 100	45	0 and 20	10	450.00	-	
4	ΔDME	100 and 75	25	0 and 30	15	375.00	-	
5	Trapezium	75 and 45	30	30 and 35	32.50	975.00	-	
6	ΔAHF	45 and 0	45	35 and 0	17.50	787.50	-	
					Total	3927.50		

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Exercise (Fig 4)

The same exercise may be used by planimeter and find the area.

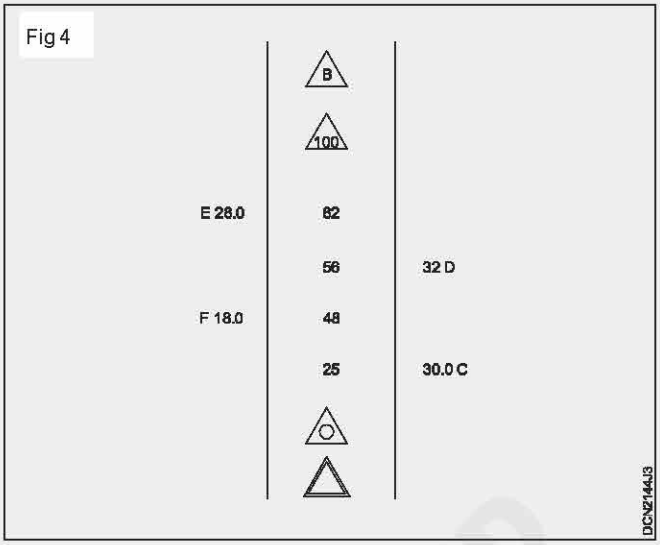
Exercise 1, (2)

Calculation of the area of an irregular field

In this survey the area of plot may be determined by the direct use of field notes.

Required Area = 814.6 x 100 = 81460m^2.

Fig 4



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Prepare site plan with the help of mouza map

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

Requirements

Tools/Equipments/Instruments

• Metric Chain 30mm	- 1 No.
• Arrow 40cm long	- 10 Nos.
• Ranging Rods 2/3m	- 6 Nos.
• Cross staff	- 1 No.
• Junior drafter	- 1 No.

Materials

• Drawing sheet A3	- 1 No.
• Field note book	- 1 No.
• Pencil HB	- 1 No.
• Eraser	- 1 No.
• Set of scale	- One set.
• Cello tape	- 1 roll.

PROCEDURE

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

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

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.

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TASK 2: **Prepare the given sketch using templates (Fig 2)**

1 Draw the plan to a scale of 1:50

2 Select the temple and create the furniture.

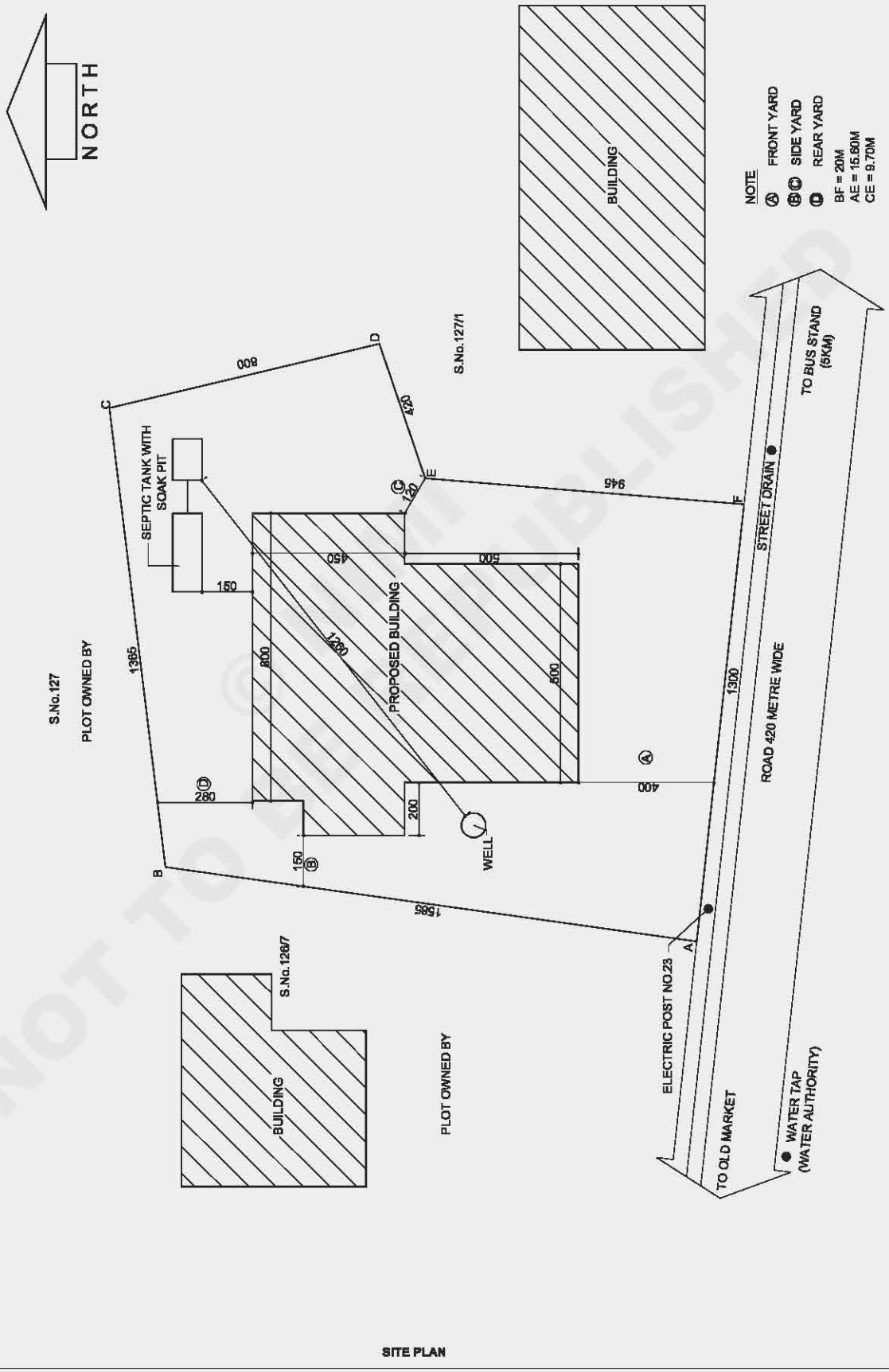
3 Furnish the surrounding details as shown, for lawn, swimming pool, garden etc.

4 Complete the drawing.

— — — — — — — —

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Fig 1



SITE PLAN

DCN2145H1

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Field work of prismatic compass survey (Triangular plot & Hexagonal plot)

Objectives: At the end of this exercise you shall be able to
- **observe the bearings of a given triangular plot & hexagonal plot**
- **calculate and check the included angles**
- **plot the area.**

Requirements

Tools/Equipments/Instruments

- Prismatic compass with tripod - 1 No.
- Ranging rods - 2 Nos.
- Wooden peg - 3 Nos.
- Chain or tape 30m - 1 No.
- Arrows - 10 Nos.

Materials

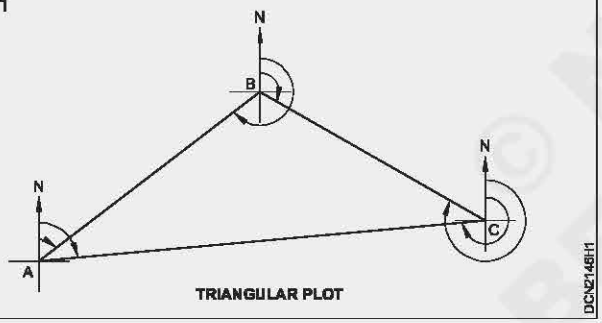
- Drawing sheet A3 - 1 No.
- Field book - 1 No.
- Pencil HB - 1 No.
- Eraser - 1 No.
- Cello tape - 1 roll.
- Set of scale - 1 set

PROCEDURE

TASK 1: **Observe the bearings of a given triangular plot**

1 Select and drive pegs at A, B and C stations which are intervisible to each other. (Fig 1)

Fig 1



2 Measure the horizontal distance of AB, BC and CA and note the readings at (1), (2) and (3) in the table respectively.

3 Fix ranging rods at stations 'B' and 'C'.

4 Set up and level the compass over the station 'A'.

5 Observe the reading by sighting 'B' and note it on (4) in the table.

6 Similarly observe the reading by sighting 'C' and note it on (5) in the table.

7 Shift the compass to station 'B'.

8 Fix the ranging rod at 'A'.

9 Setup the compass over the station 'B'.

10 Observe the readings by sighting 'C' and 'A' and note them on (6) and (7) in the table respectively.

11 Shift and setup the compass to station 'C'.

12 Fix the ranging rods at 'B'.

13 Observe the readings by sighting 'A' and 'B' and note them on (8) and (9) in the table.

Table

Line	Length in (m)	Fore bearing	Back bearing
AB	(1)	(4)	(7)
BC	(2)	(6)	(9)
CA	(3)	(8)	(5)

— — — — — — — —

TASK 2: **Calculate and check the included angles**

1 Calculate the included angles using fore bearing and back bearing.

2 Check the calculated the included angels of the triangles with the theoretical sum of angels is equal to 180°.

— — — — — — — —

TASK 3: **Plot the area**

1 Calculate the included angles using fore bearing and back bearing.

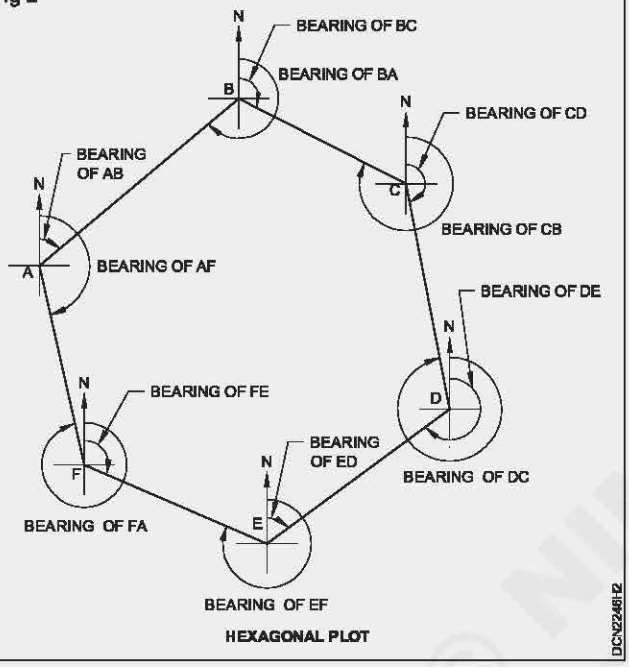
2 Check the calculated the included angels of the triangles with the theoretical sum of angels is equal to 180°.

— — — — — — — —

TASK 4 : **Observe the bearings of a given hexagonal plot**

1 Select and drive pegs at all the stations A, B, C, D, E and F which are intervisible to each other. (Fig 2)

Fig 2



2 Measure the horizontal distance of AB, BC, CD etc. and note them as mentioned in the previous method against each line.

3 Set up the compass on first station 'A' and level it.

4 Fix ranging rods at station 'B' and 'F' where the bearing is to be located and observe the bearings.

5 Note down the bearings in the field book.

6 Repeat the procedure as explained in the previous exercise and note the bearings.

— — — — — — — —

TASK 5: **Calculate and check the included angles**

1 Calculate the included angles using fore bearings and back bearings.

2 Check the included angles by using the theoretical formula (2 N - 4) Right angles.

Where N is the number of sides.

— — — — — — — —

TASK 6: **Plot the area**

1 Plot the polygonal figure and check it with the calculated included angles.

— — — — — — — —

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Exercise 1.9.47

Ploting of prismatic compass survey

Objectives: At the end of this exercise you shall be able to
- **locate the details and prepare a map.**

Requirements

Tools/Equipments/Instruments		Materials	
• Prismatic compass	- 1 No.	• Drawing sheet A2	- 1 No.
• Ranging rods	- as reqd.	• Field book	- 1 No.
• Wooden peg	- as reqd.	• Pencil HB	- 1 No.
• Pencil	- 1 No.	• Eraser	- 1 No.
• Eraser	- 1 No.	• Cello tape	- 1 roll.
• Chain or tape 30m	- 1 No.	• Set of scale	- 1 set
• Arrows	- 10 Nos.		

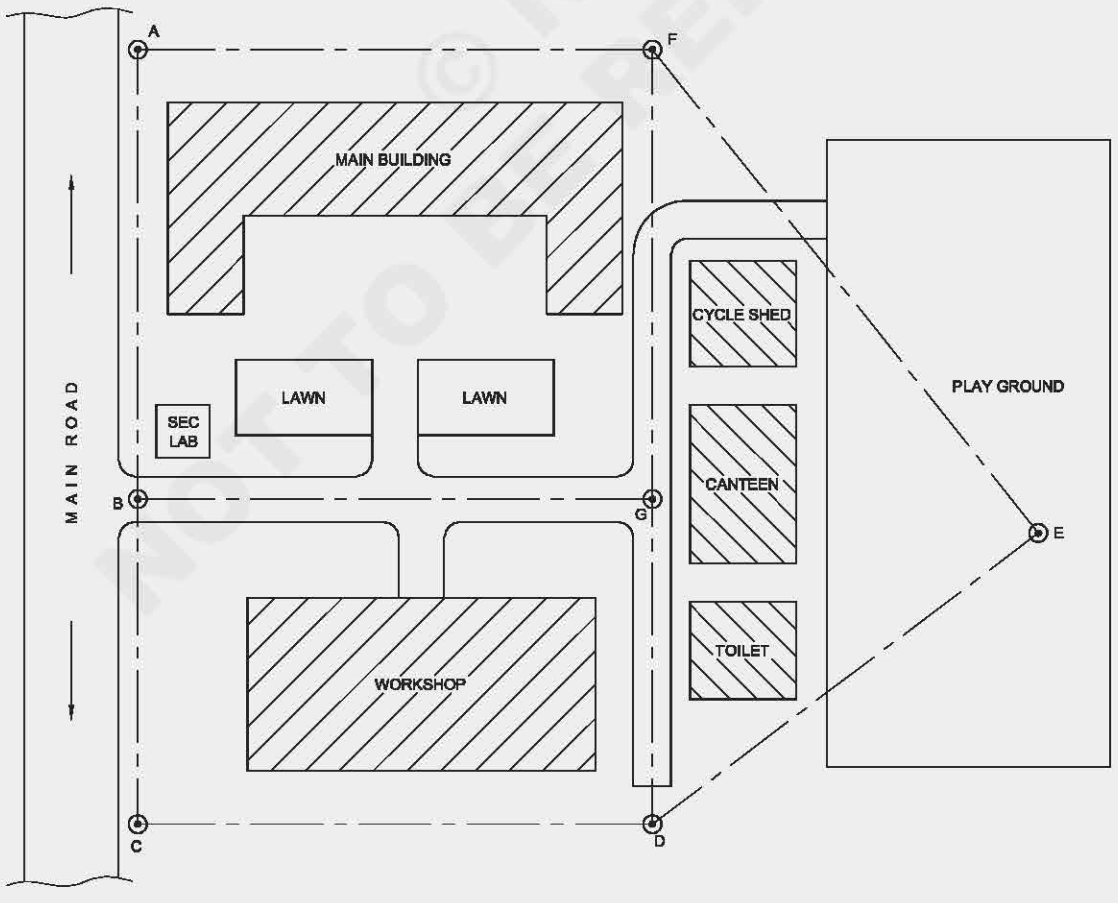
PROCEDURE

TASK 1: **Locate the details and prepare a map**

1 Make a visit to the existing site for the purpose of identifying the instrument stations, objects and special features located on the area to be surveyed (Fig 1).

2 Select an instrument stations A,B,C,D,E,F and G which gives maximum details for mapping.

Fig 1



MODEL LAYOUT OF AN INSTITUTE

DCN2247H1

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3 Setup the instrument over the selected station 'A'.

4 Fix ranging rod at stations 'B' & 'F'.

5 Sight stations 'B' & 'F' and take the bearings of 'AB' & 'AF'.

6 Run the chain along 'AB' and take offsets for objects on both sides of the chain.

7 Observation should be recorded in field book.

8 Shift the Instrument station 'B'.

9 Check the bearing by back sighting 'A'.

10 Fix a ranging rods at stations 'C' & 'G'.

11 Sight stations 'C' & 'G' and take the bearing of 'BC' & 'BG'.

12 Run the chain along BC and take offsets of objects on both sides of chain line.

13 Observations should be recorded in the field book, as per the table given below.

14 Repeat the same process to complete the whole survey.

15 Plot the map based on the bearings and distances taken.

Line	Length in (m)	Fore bearing	Back bearing
AB			
BC			
BG			
CD			
DE			
DG			
EF			
FG			
FA			

— — — — — — — —

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Testing and adjusting the prismatic compass

Objectives: At the end of this exercise you shall be able to
- **center the compass exactly over the station**
- **level the instrument**
- **focus the prism**
- **observe the bearings**
- **plot the observed bearings of the traverse.**

Requirements

Tools/Equipments/Instruments

- Prismatic compass with tripod - 1 No.
- Measuring tape 30m - 1 No.
- Ranging rod 2/3m long - 2 Nos.
- Arrows 40cm long - 2 Nos.

Materials

- Field book - 1 No.
- Ink pen - 1 No.

PROCEDURE

TASK 1: **Centering of compass**

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(a) and Fig 1(b).

8 Bring the prism arrangement from position I to position II as shown in Fig 1(a) and Fig 1(b).

9 Drop a small pebble from centre of the tripod.

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.

Fig 1(a)

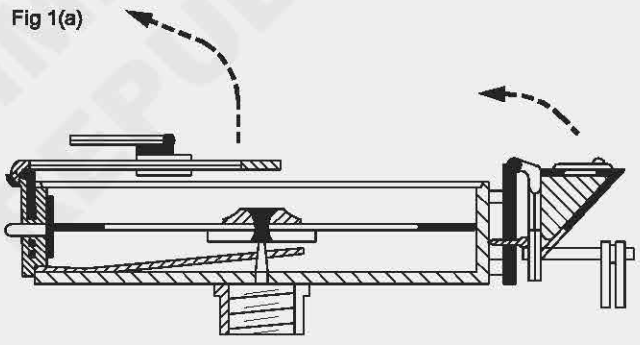


FIGURE SHOWING POSITION 1

Fig 1(b)

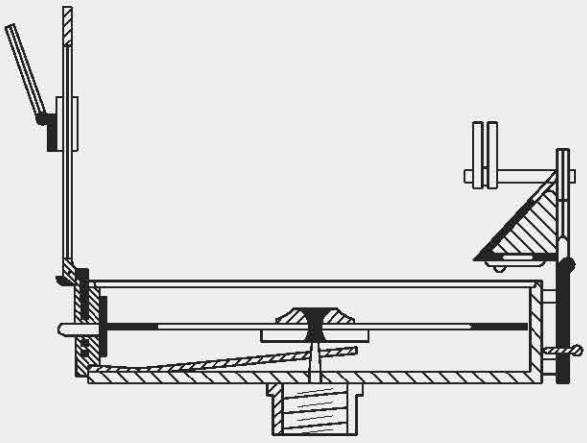


FIGURE SHOWING POSITION 2

DCN2248H1

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TASK 2: **Levelling**

1 Adjust the compas 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.

3 If the bubble is not at its centre, repeat the above procedure to bring it at its 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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Observe the bearings and plotting

Objectives: At the end of this exercise you shall be able to
- **observe the bearings**
- **plot the observed bearings of the traverse.**

Requirements

Tools/Equipments/Instruments

- Prismatic compass with tripod - 1 No.
- Measuring tape 30m - 1 No.
- Ranging rod 2/3m long - 2 Nos.
- Arrows 40cm long - 2 Nos.

Materials

- Field book - 1 No.
- Ink pen - 1 No.

PROCEDURE

TASK 1: **Observing the bearings**

1 Fix a ranging rod where the bearing is to be found.

2 After centering levelling and focussing the prism, turn the compass box until the ranging rod is bisected by the hair when looked through the slit in the prism.

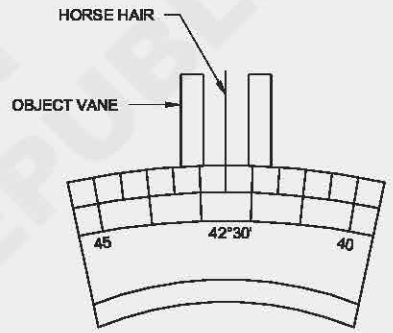
3 Allow the magnetic needle comes to rest.

4 Observe through the prism.

5 Note the reading at which the hair line cuts the image of the graduated ring as shown in Fig 1.

Sighting of the object and reading of the graduated ring should be done simultaneously.

Fig 1



TASK 2: **Plotting**

1 Before starting the plotting work calculate the included angles of the closed transverse.

2 Sum all the included angles.

3 Check the included angles with (2n - 4) x right angles (where 'n' is the number of sides).

4 Select a suitable size of drawing sheet according to the size of the site to be plotted.

5 Fix the drawing sheet on the board.

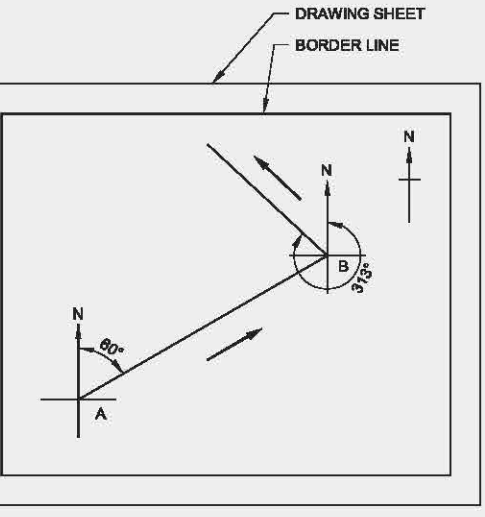
6 Draw border line and indicate the North direction on the right hand top corner of the sheet.

Method I - Parallel meridian method (Fig 1)

7 Select a suitable position to plot the first station 'A' such that all the stations can be plotted with in the drawing sheet.

8 Set the drafter parallel to the North direction and draw a vertical line on the first station 'A'.

Fig 1



PARALLEL MERIDIAN METHOD

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9 Coincide the zero mark of the circular protractor with North direction already drawn on 'A'.

10 Mark a point corresponding to the bearing of the first line 'AB'.

11 Join the station 'A' and the point noted for the bearing.

12 Extend it to a convenient length.

13 Choose a suitable scale and mark the distance of the line 'AB'.

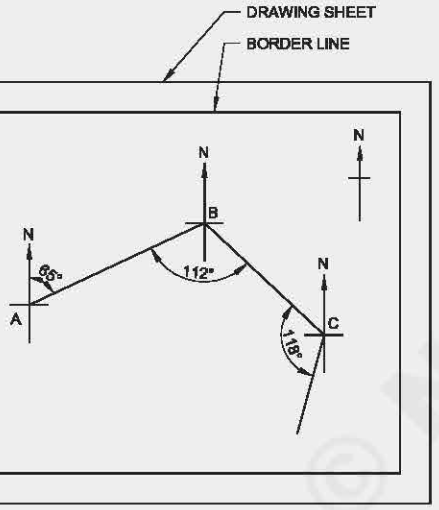
14 Denote the station as 'B'

15 Set the drafter again parallel to the North direction at 'B'

16 Continue the plotting work as mentioned above till all the stations are plotted.

Method II - Included Angle Method (Fig 2)

Fig 2



1 Mark the station 'A' and draw the first chain line AB to a suitable scale as mentioned in the method I.

2 Mark the station 'B' to a convenient scale.

3 Place the zero end of the circular protractor along BA.

4 Mark a point such that ∠ABC should be the same as calculated earlier.

5 Prolong the line through the point from B.

6 Mark the 'C' on the line to the same scale.

7 Continue the above process till all stations are plotted.

Method III - Central Meridian (or) Paper Protractor method (Fig 3)

1 Select a point 'O' in the centre of the drawing sheet.

2 Mark the North direction (meridian) on the point.

3 Keep the 0^0 and 180^0 graduations of the circular protractor coinciding with the north & south direction line with centre point 'O'.

4 Plot the bearing of all the lines with reference to the north direction as shown in Fig 3.

5 Select a suitable location to plot the first station 'A' such that all the stations can be plotted within the drawing sheet.

6 Select a suitable scale for marking field distances on the drawing sheet.

7 Set the drafter parallel to the line AB in the paper protractor which is already drawn.

8 Keep the drafter on A and draw a line parallel to the line AB which is in the paper protractor to a convenient length.

9 Mark the station B on the line, with the selected scale.

10 Set the drafter parallel to the line BC in the paper protractor which is already drawn.

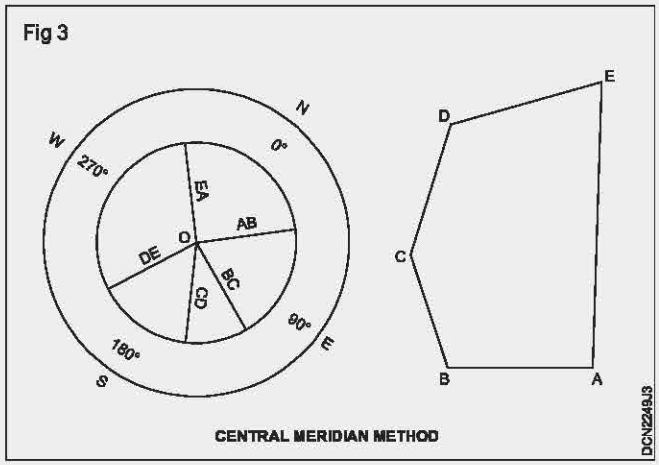
11 Keep the drafter on B and draw a line parallel to the line BC which is in the paper protractor to a convenient length.

12 Mark the station 'C' on the line to the same scale.

13 Continue the above procedure till all the stations are plotted.

14 Erase the excess lines.

Fig 3



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Bearing the line AB

Objectives: At the end of this exercise you shall be able to
- **check the bearings**
- **check the accuracy of the instrument.**

Requirements

Tools/Equipments/Instruments

- Prismatic compass with tripod - 1 No.
- Measuring tape 30m - 1 No.
- Ranging rod 2/3m long - 2 Nos.
- Arrows 40cm long - 2 Nos.

Materials

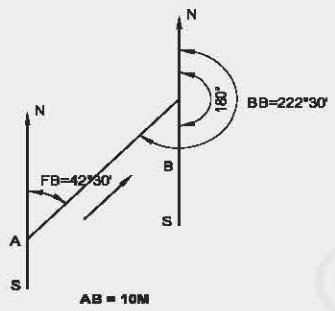
- Field book - 1 No.
- Ink pen - 1 No.

PROCEDURE

TASK 1: **Check and record the bearings and personal error**

1 Select a line AB on a firm ground to a given length of 10m. (Fig 1)

Fig 1



The stations A and B should be selected free from local attraction.

2 Fix arrows at stations 'A' and 'B'.

3 Setup the prismatic compass over the station 'A'.

4 Centre the compass over the station 'A' and level it.

5 Fix a ranging rod at the station 'B'.

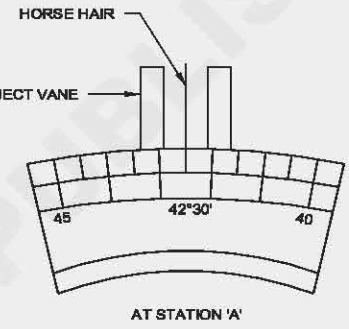
6 Turn the compass box until the ranging rod at station 'B' is bisected by the vertical hair of the object vane through the slit of the eye vane.

7 When the graduated ring comes to rest look through the prism and note the reading (42^0 30') at which the hair line produced appears to cut the image of the graduated ring (Fig 2).

8 Thus the required fore bearing of line AB is $42^0$30' and record it in the Field Book.

The sighting of the object and reading of the graduated ring are done simultaneously

Fig 2



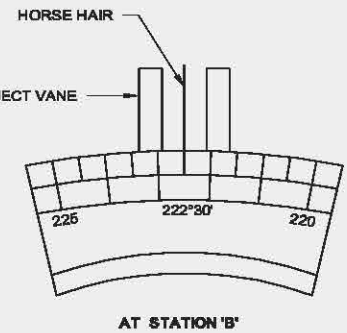
9 Shift the instrument, and setup at station 'B'.

10 Fix the Ranging rod at station 'A'.

11 Turn the compass Box, to sight the station 'A'.

12 Observe the bearing i.e. Back Bearing of the line 'AB' (222^0 30') Fig 3) and record it in the Field book.

Fig 3



TASK 2: **Check the accuracy of the instrument and personal error**

1 Back bearing of the given line AB is equal to fore bearing of the given line AB ± 180^0.

If the above condition is not satisfied with the observed back bearing of AB, then the instrument is having some error due to local attraction or wrong observation or wrong entry in the field book.

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Traverse survey and check the close surveying

Objectives: At the end of this exercise you shall be able to
- **set out the rectilinear field as a per the given readings**
- **survey and locate the group of building by plane tabling.**

Requirements

Tools/Equipments/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.
• Prismatic compass	- 1 No.
• Measuring (30m) steel tape,	- 1 No.
• Chain 30m	- 1 No.
• Arrows	- 10 Nos.
• Pegs	- 10 Nos.
• Ranging Rod	- 2 Nos.

Materials

• Set of scale	- one set
• Pencil, Eraser etc.	- each one
• Drawing sheet A2	- 1 No.
• Drawing sheet A3	- 1 No.
• Field book with given data	- 1 No.
• Cello tape	- 1 roll.
• Set of scale	- 1 set

PROCEDURE

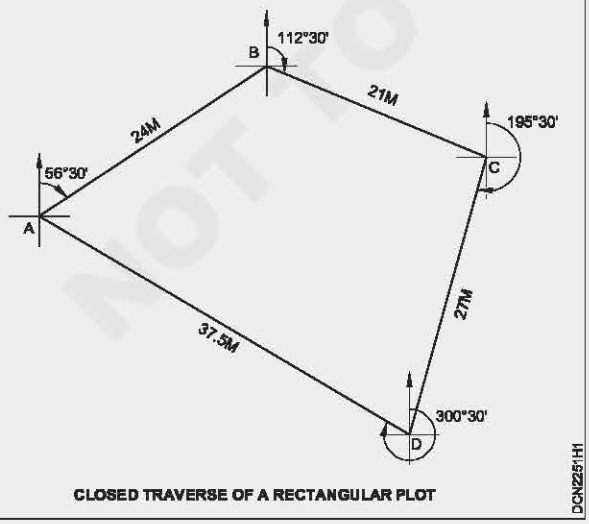
TASK 1: **Set out the rectilinear field as a per the given readings**

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. $(2n - 4)90^0$.

2 Plot the traverse ABCDA with the given bearings and lengths.

3 Select a field without local attraction as far as possible for settingout a rectangular plot. (Fig 1)

Fig 1



CLOSED TRAVERSE OF A RECTANGULAR PLOT

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'.

10 Observe the back bearing of AB and check it with the given bearing of $236^0 30'$.

If the observed back bearing of AB is not same as the given bearing the occured error may be,

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.

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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'

— — — — — — — —

TASK 2: **Survey and locate the group of building by plane tabling**

Assume plane table survey to be conducted for the area shown in the area. (Fig 2)

1 Select the stations A,B,C,D,E,F,G,H,I,J around the buildings.

2 Set up the table at station A with drawing sheet, level it and orient it.

3 With the help of a trough compass mark the magnetic north on the sheet.

4 Select a suitable scale to locate the details and draw the map.

5 From station A, locate the stations B and H and details of the building corner.

6 Shift the table to station B and locate stations C and I and other details.

7 Similarly shift the table to C, D, E, F, G, H and also at I and J to take the details.

The corners of the building, road etc are taken by radiation or intersection method.

8 Follow the procedure already explained in 1.4.05.

9 Check the closing error after finishing at the starting point A.

10 Note the name of the building, features, important notes side by side while plotting.

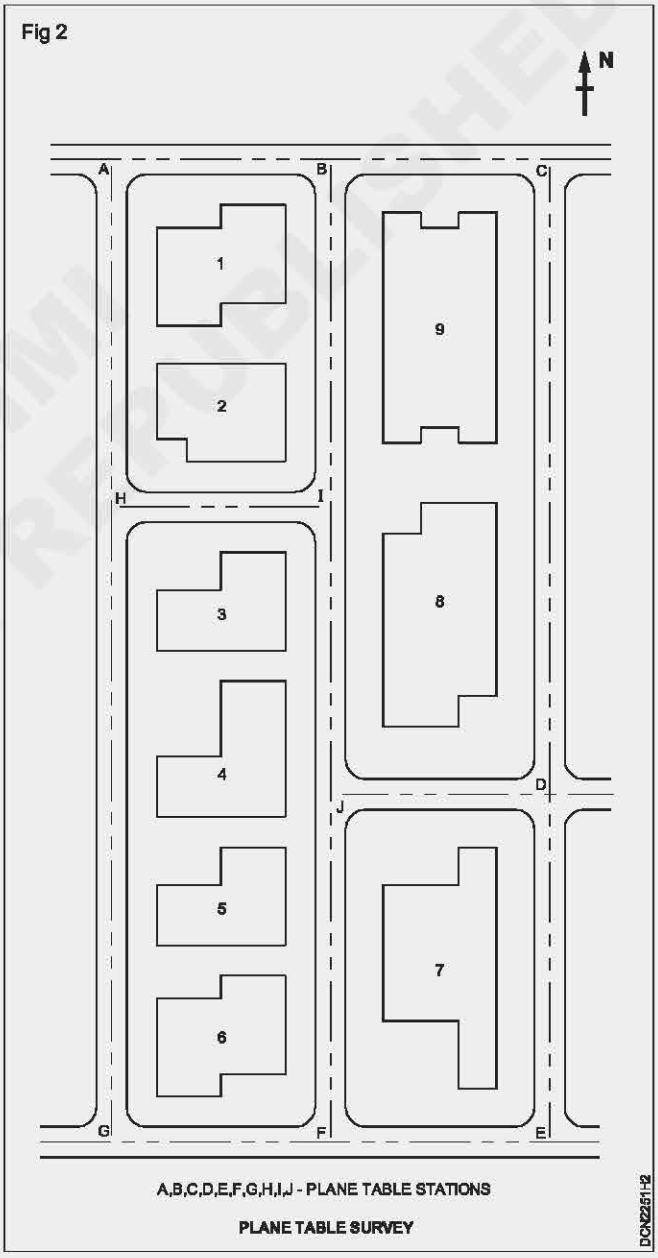
11 After locating all details, remove the sheet.

Necessary inking and colouring should be done.

Due to long distance GH the details of 4 and 5 cannot be visible Hence this may be omitted in this exercise.

The details 4 and 5 should be taken by using Two point in following exercise 1.10.52.

Fig 2



— — — — — — — —

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Practice on plane tabling by radiation method orientation of plane table

Objectives: At the end of this exercise you shall be able to
- **set out the rectilinear field as a per the given readings**
- **survey and locate the group of building by plane tabling**
- **locate and reproduce the ground boundary points on the sheet**
- **survey and locate the boundaries and details of land by Radiation method**
- **survey and locate the boundaries by intersection method.**

Requirements

Tools/Equipments/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 (30m) steel tape	- 1 No.
• Pegs	- 6 Nos.
• Arrows	- 10 Nos.
• Ranging rod	- 3 Nos.

Materials

• Existing layout plan	- 1 No.
• Set of scale	- 1 set.
• Pencil, Eraser etc.	- each one
• Cello tape	- 1 roll.

PROCEDURE

TASK 1: **Orient the table to find a new station point and locate the new building**

1 Select 'A' and 'B' be the two known points of the corners of building No.3 which is the plotted positions as 'ab' on the map in Ex. No. 1.9.51 (Fig 1a and 1b).

2 Fix the map of Ex.1.9.51 on the plane table board.

3 Use the two point problem to find the details of building No.4 and 5 which is to be omitted in Ex.1.9.51.

4 Select a temporary point 'P' and an approximate point 'C' on the ground in front of building corners A and B such that the angles ∠PAC and ∠PBC are not less than 30^0 for good intersection.

5 Set up the table over 'P'

6 Orient the table in such a way that the plotted position 'ab' is approximately parallel to 'AB'

7 Place the alidade on 'a'.

8 Sight A and draw a back ray.

9 Place the alidade on 'b'.

10 Sight B and draw a back ray.

11 Denote as 'p_1' where the two back rays intersect each other.

12 Transfer the point 'p_1' to Ground as p_1.

13 Fix a ranging rod at the approximate station at 'C'.

14 Place the alidade on 'p_1' and draw a ray towards 'C'.

15 Choose any point 'c_1' on the line 'PC' by estimation.

16 Shift the table to 'C' and set up it with 'c_1'.

17 Orient the table with 'c_1p_1' by sighting 'P'.

18 Place the alidade on 'a' and sight A , draw a back ray.

19 Denote 'c_2' where the backray from 'a' cuts the line 'p_1c_1'.

20 Place the alidade on 'c_2' and sight 'B'.

21 Draw a ray towards 'B'.

22 Denote the point 'b1' where the ray 'c2B' meets the ray already drawn p1b produced.

If the table is exactly oriented to AB, then ray drawn c2B which will pass through the already plotted point 'b'.

23 Now the line 'ab_1' is exactly parallel to the building points A & B.

24 Place the alidade 'ab_1'.

25 Fix a ranging rod at 'R' in the line of sight 'ab1' at a distance not less than 8m.

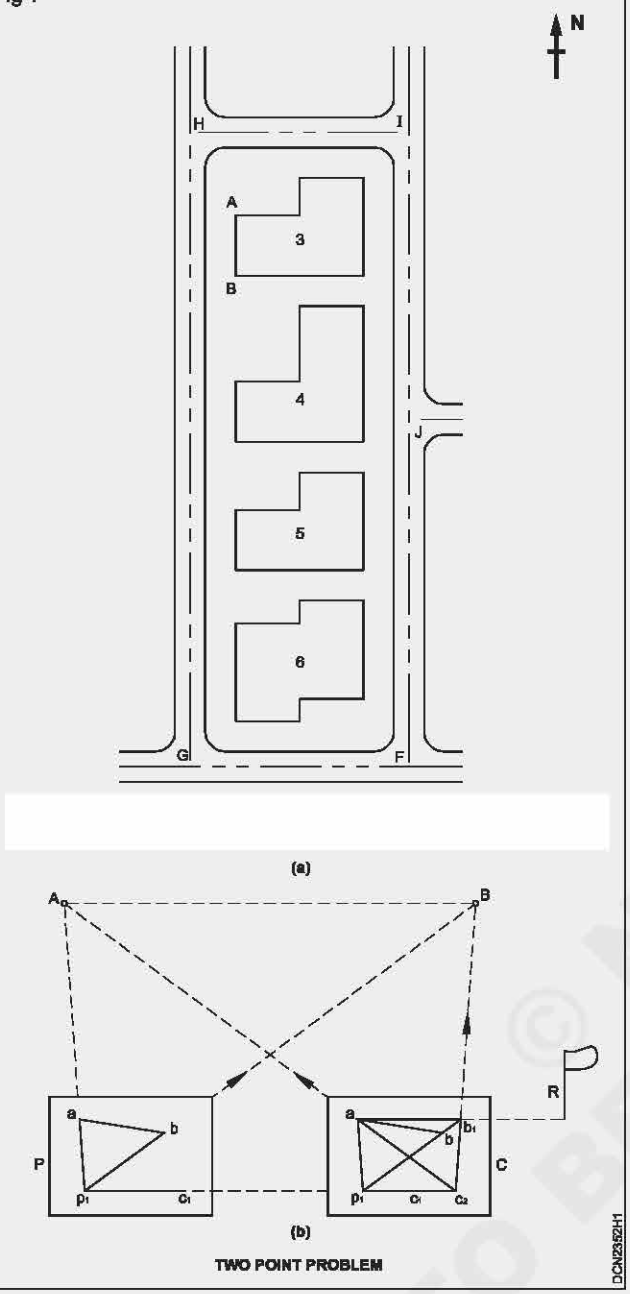
26 Place the alidade along 'ab' and unclamp the table.

27 Rotate the table until the Ranging Rod 'R' is again sighted.

28 Tighten the clamp. Now the table is exactly oriented to the building position AB.

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Fig 1



29 Place the alidade on 'a' sight A and draw a back ray.

30 Similarly place the alidade on 'b' sight B and draw a back ray.

31 Denote the point 'c' where the above two rays intersect each other.

32 Transfer the plotted point 'c' in the map into ground as 'C'

33 Start the survey to locate the new objects in the old map with reference to this instrument station.

Measure the ground distance CA,CB, and check it with plotted distance ca,cb.

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TASK 2: **Locate and reproduce the ground boundary points on the sheet**

1 Select the given boundary points A,B,C,D,E and F on the ground and drive pegs.

2 Select the point T so that all points A,B,C,D,E and F are visible from station T.

3 Set up the plane table over the station T.

4 Clamp the board after centering and levelling the plane table.

5 Fix the given drawing sheet over the plane table.

6 Select a point 't' on the drawing sheet exactly over the ground station T with the help of plumbing fork and plumb bob.

7 Mark the magnetic north on the right hand top corner with the help of trough compass.

8 Fix a pin on drawing sheet at 't'.

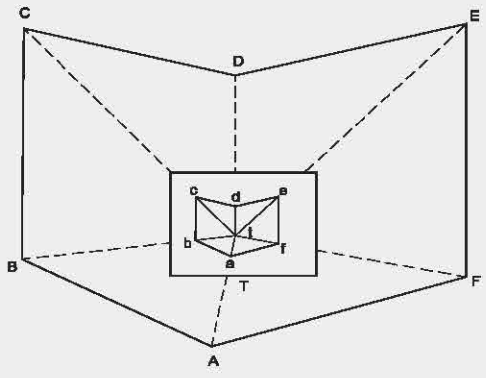
9 Pivot the alidade on 't' sight the points A,B,C,D,E and F and draw rays along the fiducial edge of the alidade, and denote a,b,c,d,e and f to their respective rays with a pencil.

10 Measure the ground distances TA,TB,TC,TD,TE and TF by tape.

11 Plot the distances to a convenient scale along the respective rays, thus getting a, b, c, d, e and f.

12 Join the points a,b,c,d,e and f on the sheet to give the out line of the Boundary. (Fig 2)

Fig 2



RADIATION

DCN2352-H2

Care must be taken to see that the alidade is touching the point 't' while the sights are being taken

Check:
The field work can be checked by measuring the distances AB,BC,CD etc and comparing them with their plotted lengths of ab,bc,cd,dc,ef and fa.

Skill sequence

Levelling the plane table

Objective: This shall help you to
- **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.

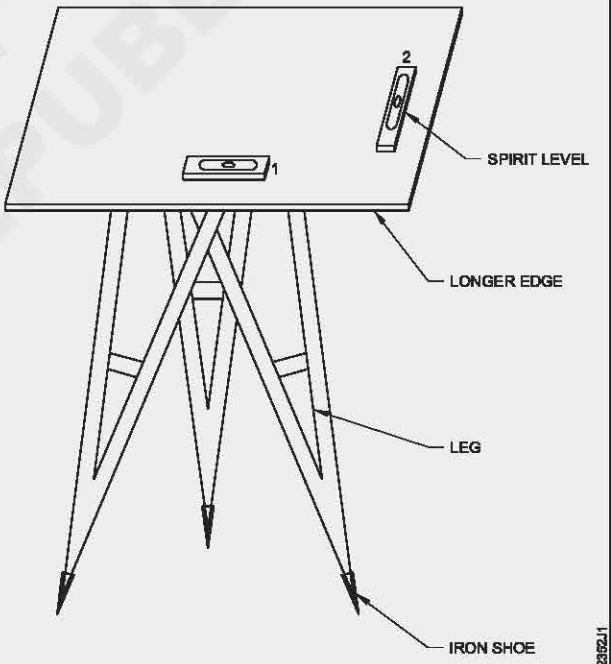
7 Place the spirit level on the table perpendicular to its previous position as in position 2 of Fig 1.

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.

10 Repeat the above process until the bubble of the spirit level remains central in all positions.

Fig 1



LEVELLING THE PLANE TABLE

DCN2352J1

Centering

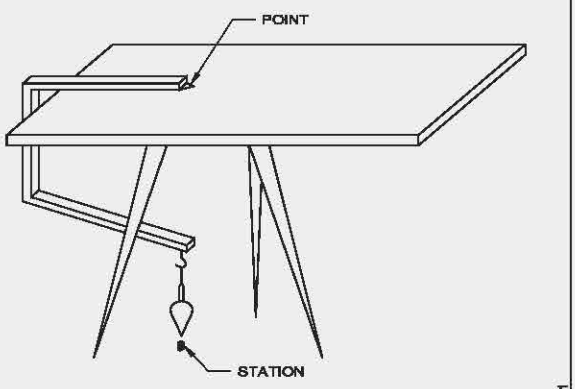
Objective: This shall help you to
- **center the plane table over a station.**

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)

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Fig 1



CENTERING THE STATION

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.

Orientation of plane table

Objective: This shall help you to

- **set the table in parallel with the existing points.**

Two methods of orientation are,

– Orientation of the plane table with a magnetic compass.

– Orientation of the plane table by Back sighting (alidadle).

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.

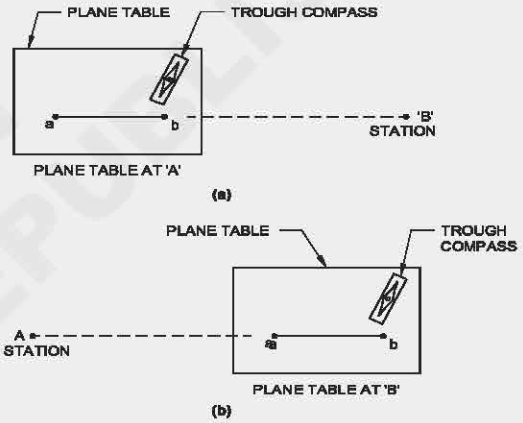
10 Place the compass along the north line already marked on the sheet.

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 is not an accurate if any of the stations are affected by local attraction.

Fig 1



ORIENTATION WITH MAGNETIC COMPASS

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. 2a)

3 Place the alidade along the ray 'ba' already drawn from the previous station to sight 'A'.

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.

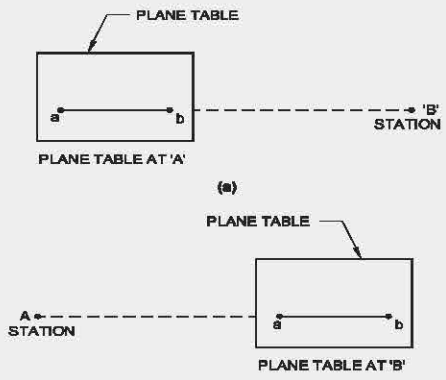
1 Now check the centering of the plane table over station 'B' with plotted position 'b' and correct it by bodily shifting the table.

2 Again keep the alidade along 'ba' and sight 'A' and rotate the table until it bisects 'A'.

3 Repeat the above two process simultaneously until to get the exact orientation. Fig. 2b.

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Fig 2



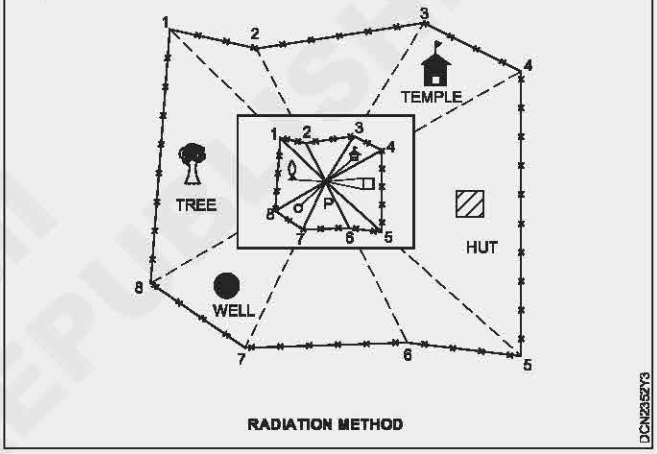
TASK 3: **Survey and locate the boundaries and details of land by radiation method**

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 3.
2 Let tree, temple, Hut & well be the some objects situated within the boundary as shown in Fig 3.
3 Select a station point 'P' which is visible from all the boundary points and the objects with in the boundary.
4 Setup 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, wall etc. with the use of alidade.

With the same scale mark and draw the conventional symbols for the different details.

Fig 3



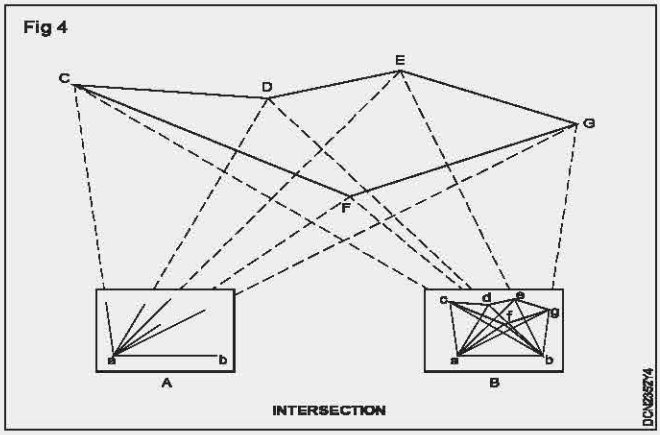
TASK 4: **Survey and locate the boundaries by intersection method**

1 Select 5 boundary points C,D,E,F &G on the ground and drive pegs. (Fig 4)
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.

Fig 4



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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Carpentry joint

Objectives: At the end of this exercise you shall be able to
- **draw the views of lengthening joints**
- **draw the views of widening joints**
- **draw the views of bearing joints**
- **draw the views of angled or corner joints**
- **draw the views of oblique shouldered joints**
- **draw the views of through housing joint**
- **draw the views of housing joint (Single dovetail)**
- **draw the views of housing joint (stopped housing with shoulder)**
- **draw the different varieties of panels**
- **draw the different forms of moulding.**

PROCEDURE

TASK 1: **Draw the plan and elevation of different types of lengthening joints (Fig 1)**

DATA: Width of the member - 300mm.
Thickness of the member - 200mm.
Length of the member - can be assumed.

- Draw the plan and elevation of lapped joints using member size 300x200mm.
- Draw the elevation of finished joints with single fish plates, double fish plates and intented fish plates.
- Draw the elevation of scarfed or spliced joints.
- Draw the elevation of table joints.

— — — — — — — —

TASK 2: **Draw the sectional elevation of widening joints (Fig 2)**

DATA : Thickness of member - 200 mm.

Draw the sectional elevation of

- Butt joint.
- Rebated joint.
- Rebated and filleted joint.
- Ploughed and tongued joint.
- Tougued and grooved joint.
- Rebated, tougued and grooved joint.
- Splayed, dowelled, matched and beaded, matched and V-joint and dovetailed joint.

— — — — — — — —

TASK 3 : **Draw the views of bearing joints, angle joints and oblique shouldered joints (Fig 3, Fig 4, Fig 5)**

Width of the member - 300 mm.

Thickness of the memeber - 200 mm.

1 Draw the three dimensional views of halved joint, notched joint cogged joint, housed joint, chase - mortise joint,dovetailed joint mortise and tenon joint, joggled joint, bridled joint, tusk and tenon joints.

2 Draw the sketches of Angled or corner joint and oblique shouldered joint.

DATA :

Size of the members can be assumed suitably.

Draw the all types of bearing joints.

Draw the oblique shouldered joints.

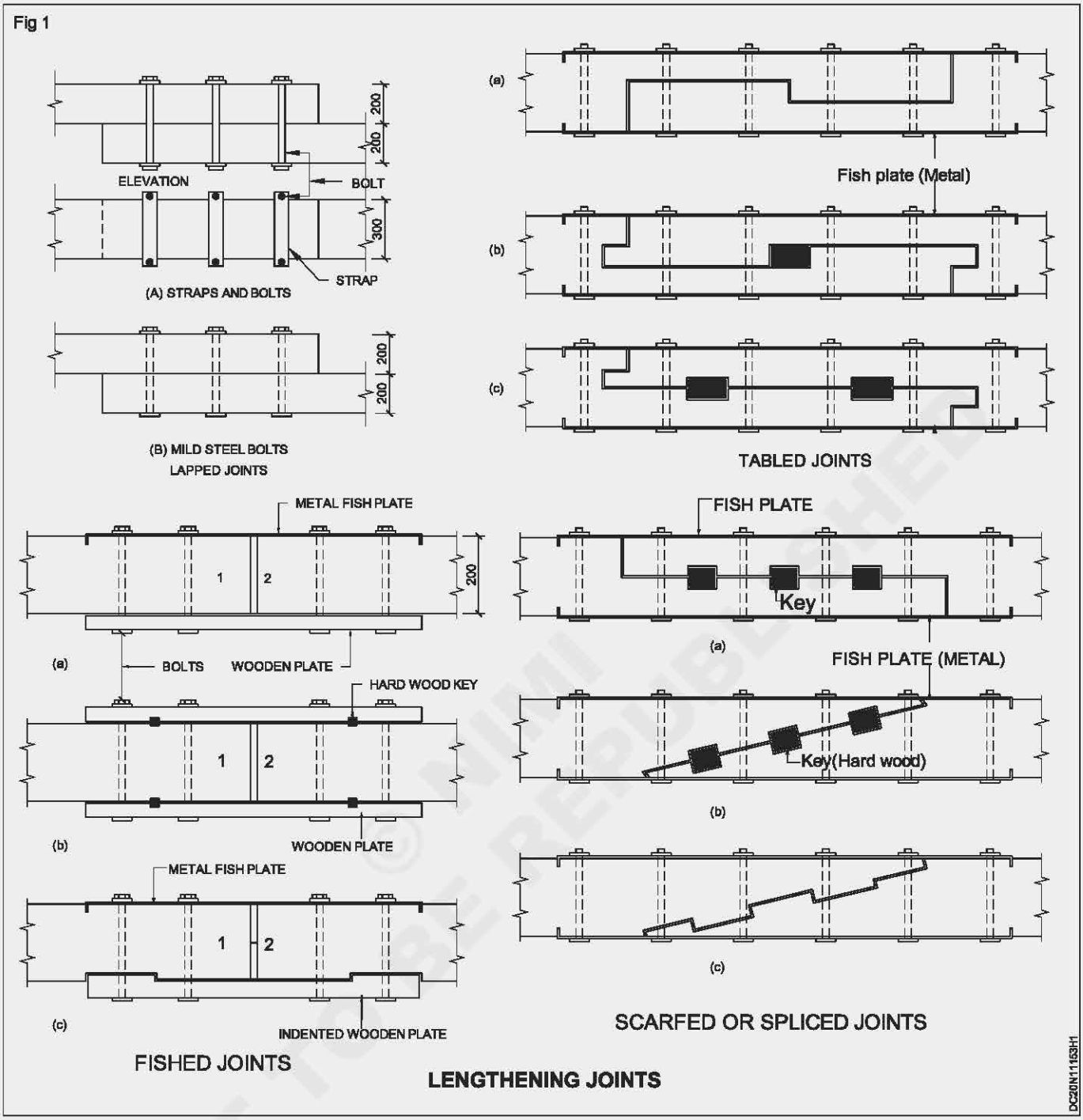
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TASK 4: **Draw the views of through housing joint (Fig 6)**

— — — — — — — —

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Fig 1



TASK 5: **Draw the views of housing joint (Single dovetail) (Fig 7)**

— — — — — — — —

TASK 6: **Draw the views of housing joint (stopped housing with shoulder) (Fig 8)**

— — — — — — — —

TASK 7: **For the given different verities of panels, prepare the drawing proportionately (Fig 9)**

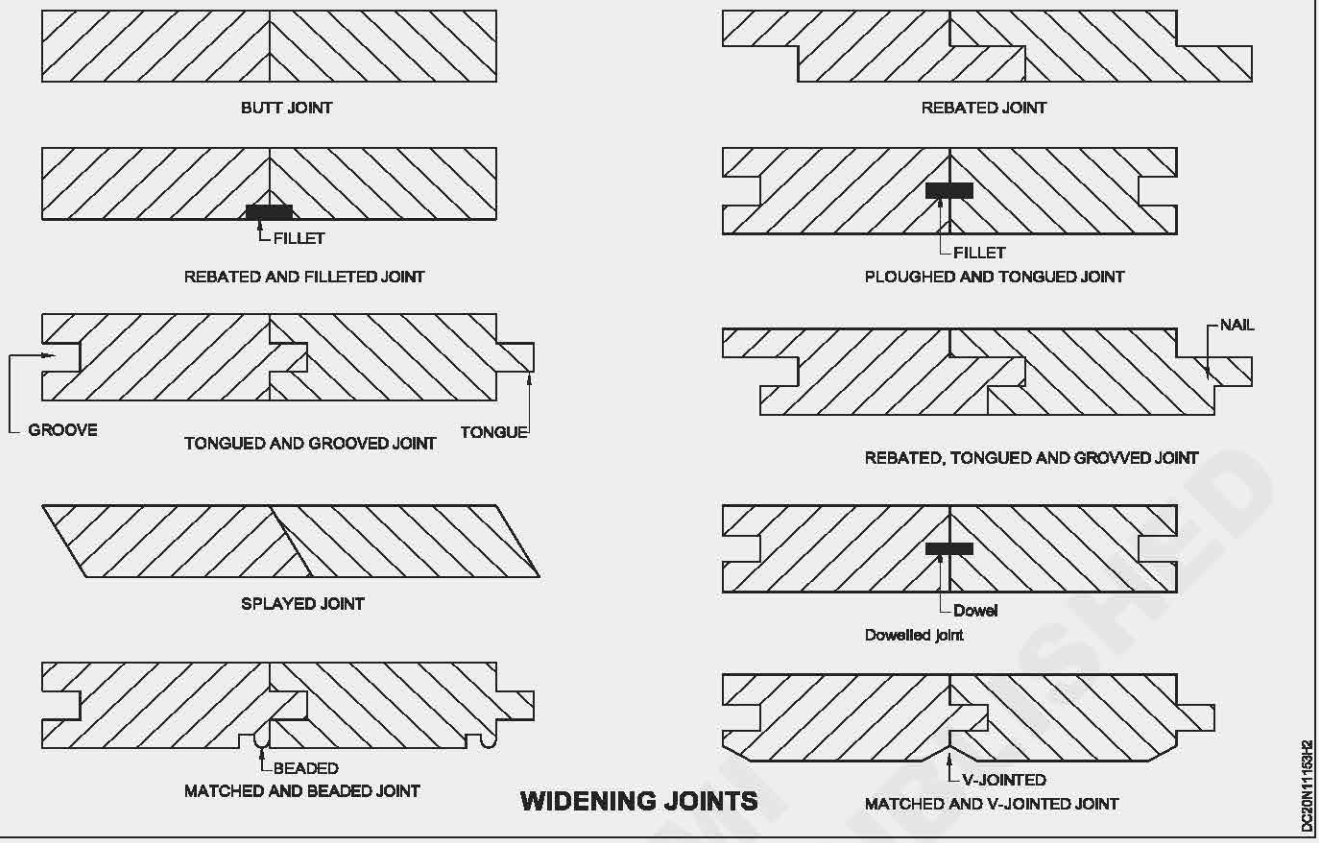
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TASK 8: **For the given different forms of moulding, prepare the drawing propertionaly (Fig 10)**

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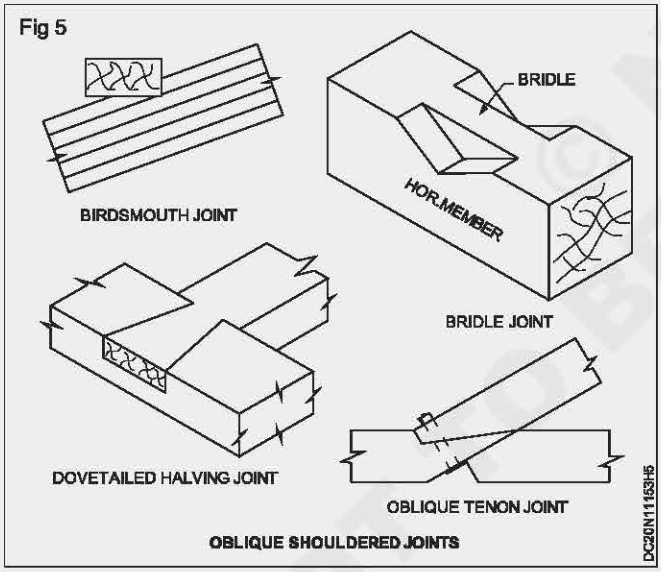
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Fig 2



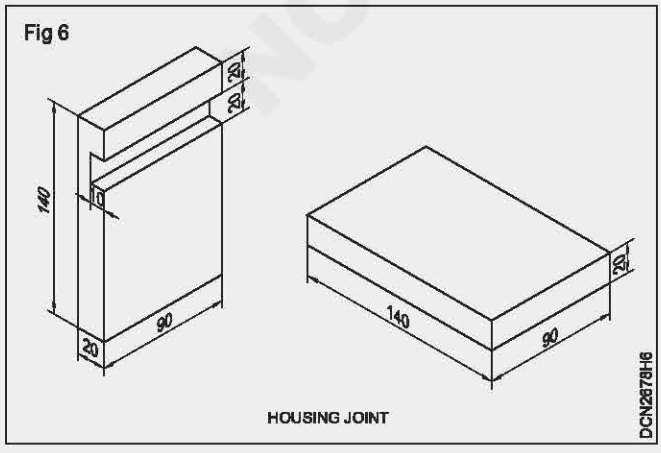
WIDENING JOINTS

Fig 5



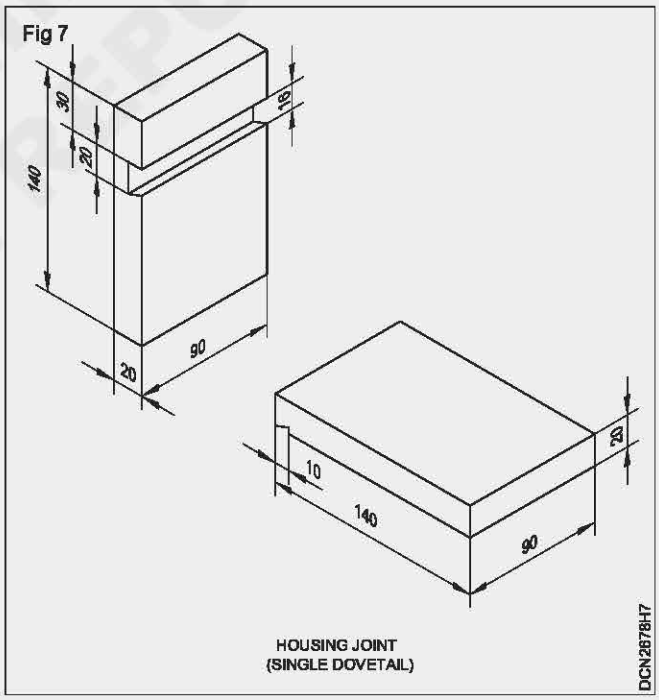
OBLIQUE SHOULDERED JOINTS

Fig 6



HOUSING JOINT

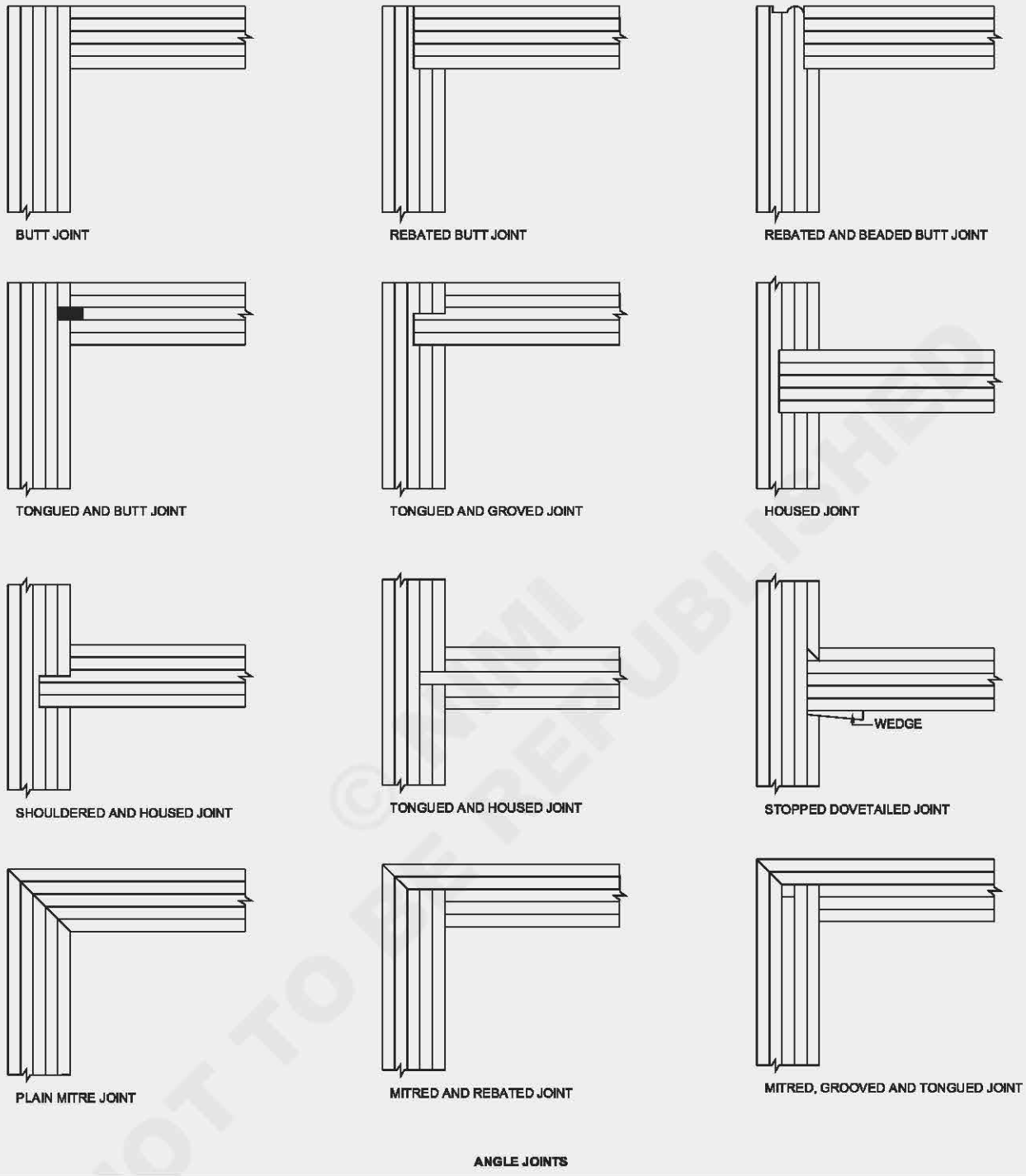
Fig 7



HOUSING JOINT
(SINGLE DOVETAIL)

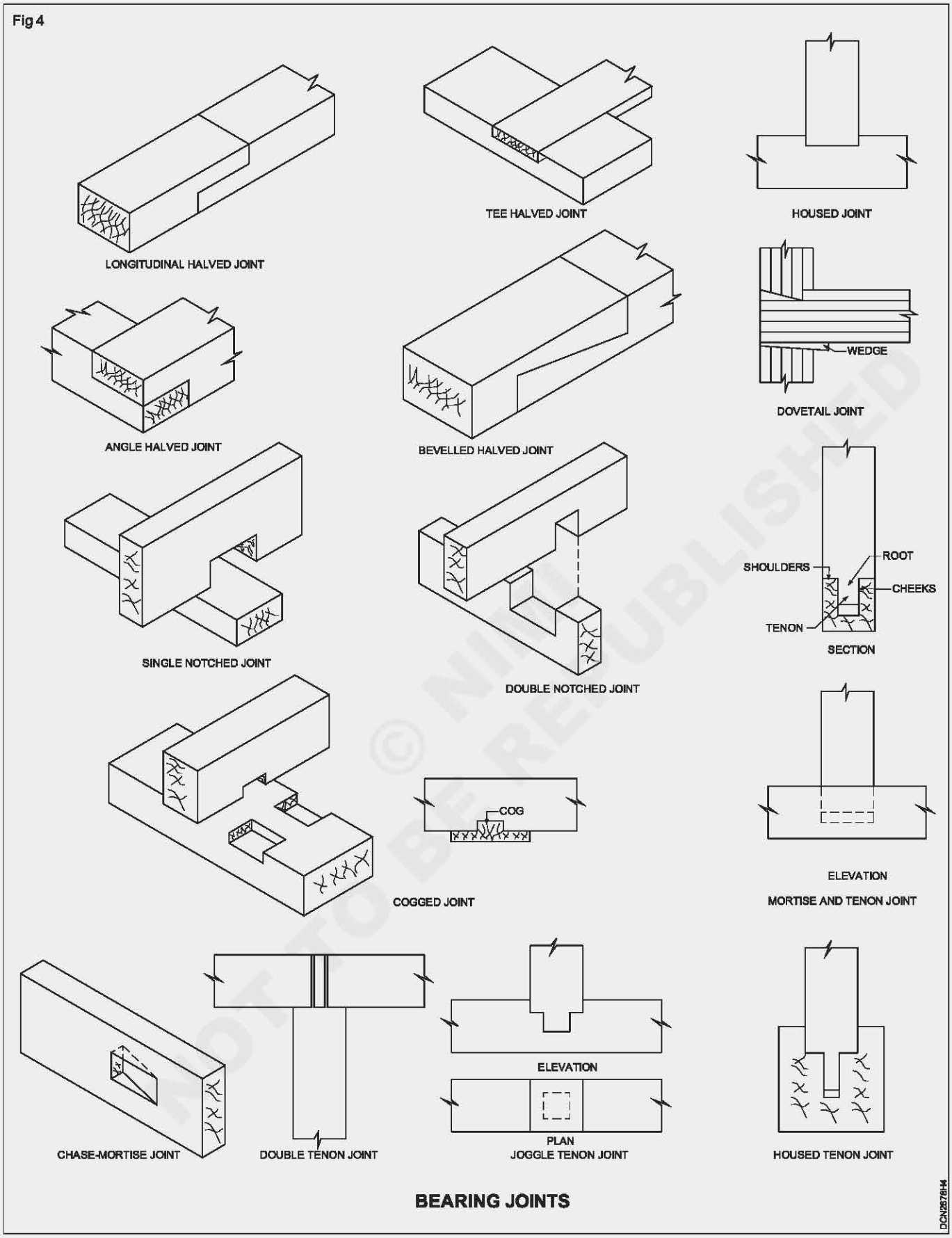
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Fig 3



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Fig 4

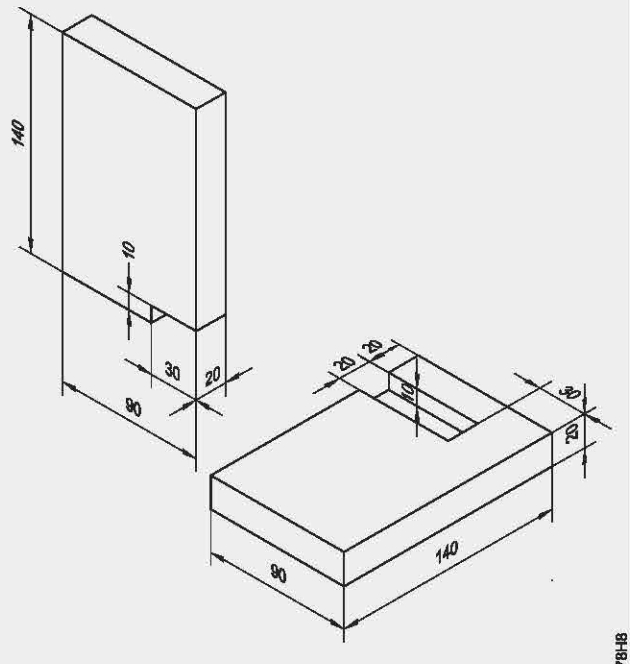


BEARING JOINTS

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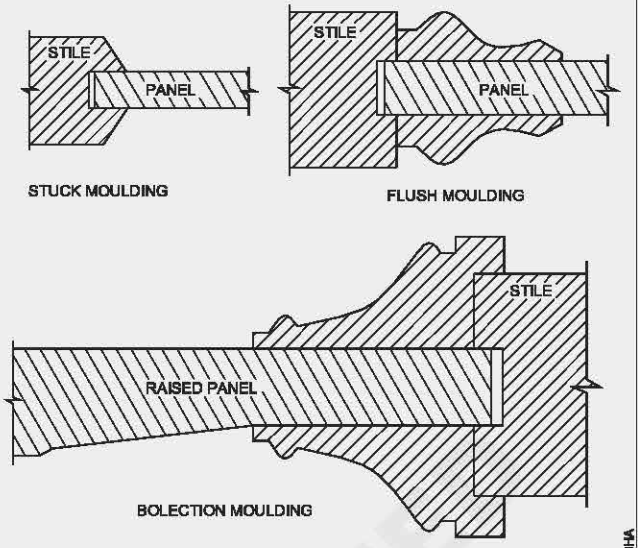
Fig 8



HOUSING JOINT
(STOPPED HOUSING WITH SHOULDER)

DCN2678H8

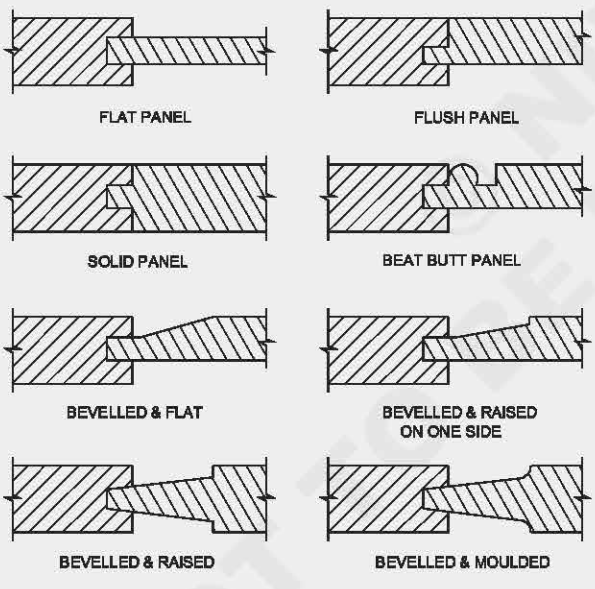
Fig 10



FORMS OF MOULDING

DCN2678HA

Fig 9



DIFFERENT VARIETIES OF PANELS

DCN2678H9

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Types of doors - I

Objectives: At the end of this exercise you shall be able to
- **draw the views of ledged and battened door**
- **draw the views of ledged, battened and braced door**
- **draw the views of ledged, battened, braced and framed door.**

PROCEDURE

TASK 1; **Draw the, elevation and vertical section of ledged and battened door (Fig 1)**

DATA

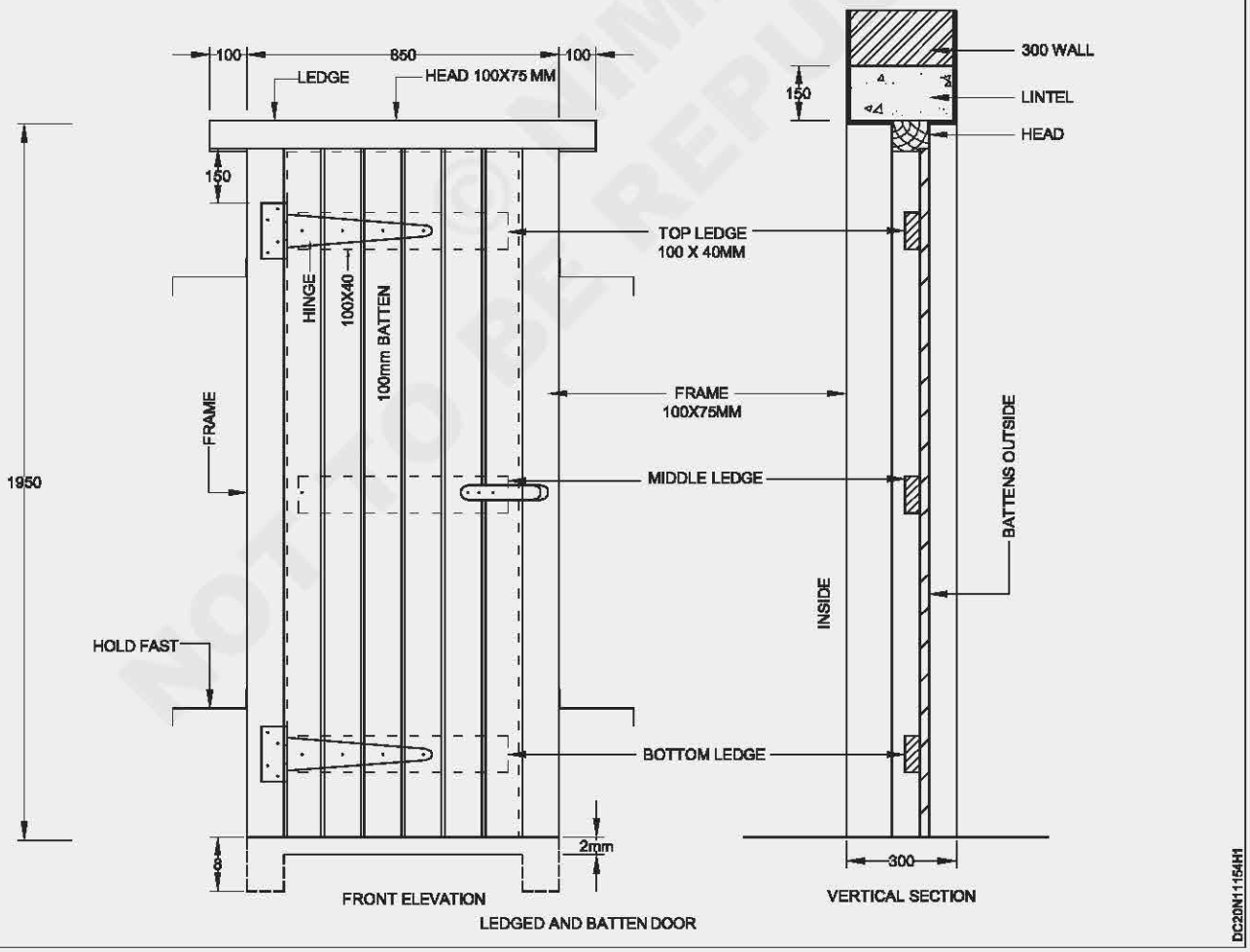
Width of wall	- 300 mm.
Height of lintel	- 150 mm.
Size of door	- 850 x 1950 mm.

Frame size

Head frame	- 100 x 75 mm.
Post	- 100 x 75 mm.
Ledge	- 100 x 40 mm -3 Nos.
Batten	- 32 mm thick - 6 Nos.
Length of hinges	- 400 mm -2 Nos.

- Draw the door opening, size 850 x 1950 mm.
- Draw two door posts, thickness 75 mm and height 1875 mm, at a distance of 700 mm apart.
- Draw door head 75 mm thick and 1050 mm length.
- Draw batten 6 nos, 117 mm width between the posts.

Fig 1



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- Draw top, middle and bottom ledges, of size 100 x 40 mm as shown in figure.
- Draw two hinges of length 400 mm at a suitable position.
- Develop the vertical section and fili the details as shown in figure.
- Complete the drawing.

— — — — — — — —

TASK 3 **Draw the vertical section, elevation of leged, framed and braced door**

DATA

Width of wall	- 300 mm.
Height of lintel	- 150 mm.
Size of door	- 900 x 2000 mm.
Frame size:	
Head frame	- 100 x 75.
Post	- 100 x 75 mm.
Ledge	- 100 x 30 mm -3 Nos.
Batten	- 30 mm thick - 4 Nos.
Styles	- 125 x 40 mm thick, 2 Nos.
Length of hinges	- 400 mm -3 Nos.

- Draw the door opening, size 900 x 2000m.
- Draw two posts, thickness 75 mm and height 1925 mm, at a distance of 750 mm apart.
- Draw door head 75 mm thick and 1200 mm length.
- Draw styles 125 x 40 mm thick 2 Nos.
- Draw battens 4 Nos, 125 mm width between the styles.
- Draw top, middle and bottom ledges as shown in figure.
- Draw the hinges 400 mm - 2 Nos.
- Draw braces inclined between top and middle ledges and middle and bottom ledge.
- Develop the vertical section and mark the symbol and complete the drawing.

— — — — — — — —

Types of doors - II

Objectives: At the end of this exercise, you shall be able to, draw the views of
- **panelled door**
- **panelled and glazed door.**

TASK 1: **Draw the vertical section, elevation of panelled door (Fig 1)**

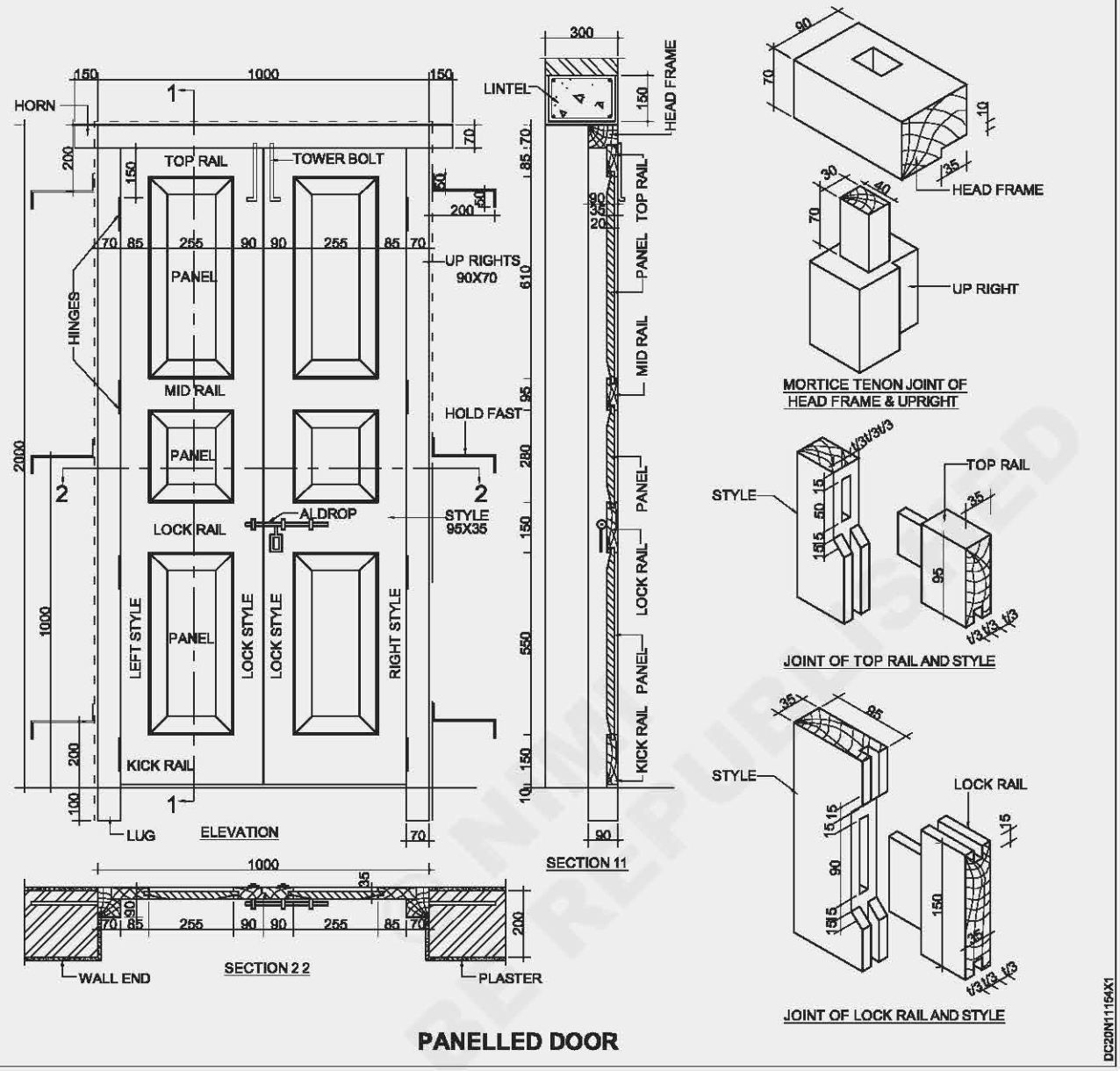
DATA

Width of wall	- 300 mm.
Height of lintel	- 150 mm.
Size of door	- 1000 x 2000 mm.
Frame size:	
Head frame	- 90 x 70 mm.
Post	- 90 x 70 mm.
Vertical styles	- 95 x 35 mm -4 Nos.
Top rail	- 95 x 35 mm.
Lock rail	- 150 x 35 mm.
Mid rail	- 95 x 35 mm.
Butt hinges	- 100 mm 4 Nos.
Pannel	- 6 Nos. of equal size, 20 mm thick.

- Draw door opening, size 1000 x 2000 mm.
- Draw two post 70 mm thick, height 1930 mm at a distance of 860 mm apart.
- Draw door head 70 mm thick 1300 mm length inclined the horn.
- Draw style of size 95 x 35 mm near the two post.
- Draw top rail 95 x 35 mm.
- Draw panel size 20 mm thick.
- Draw widrail 95 x 35 mm.
- Draw lock rail 150 x 35 mm.
- Draw the bottom rail 150 x 35 mm.
- Draw panels and butt hinges as shown in figure.
- Mark the aldrop in lock rail and complete the drawing.
- Draw the vertical section and mark the symbols and complete the drawing.

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Fig 1



PANELLED DOOR

TASK 2: **Draw the elevation and vertical section of panalled and glazed door (Fig 2)**

DATA

Width of wall - 200 mm

Height of lintel - 150 mm.

Size of door - 1000 x 2000 mm.

Frame size -

Head frame - 90 x 70 mm.

Post - 90 x 70 mm.

Vertical styles - 95 x 35 mm thick 4 Nos.

Top rail - 95 x 35 mm.

Lock rail - 195 x 35 mm.

Bottom - 195 x 35 mm.

Butt hinges - 100 mm 4 Nos.

Glass pannel - 6 Nos. of equal size, 20 mm thick.

Pannel - 2 Nos. of equal size, 20 mm thick.

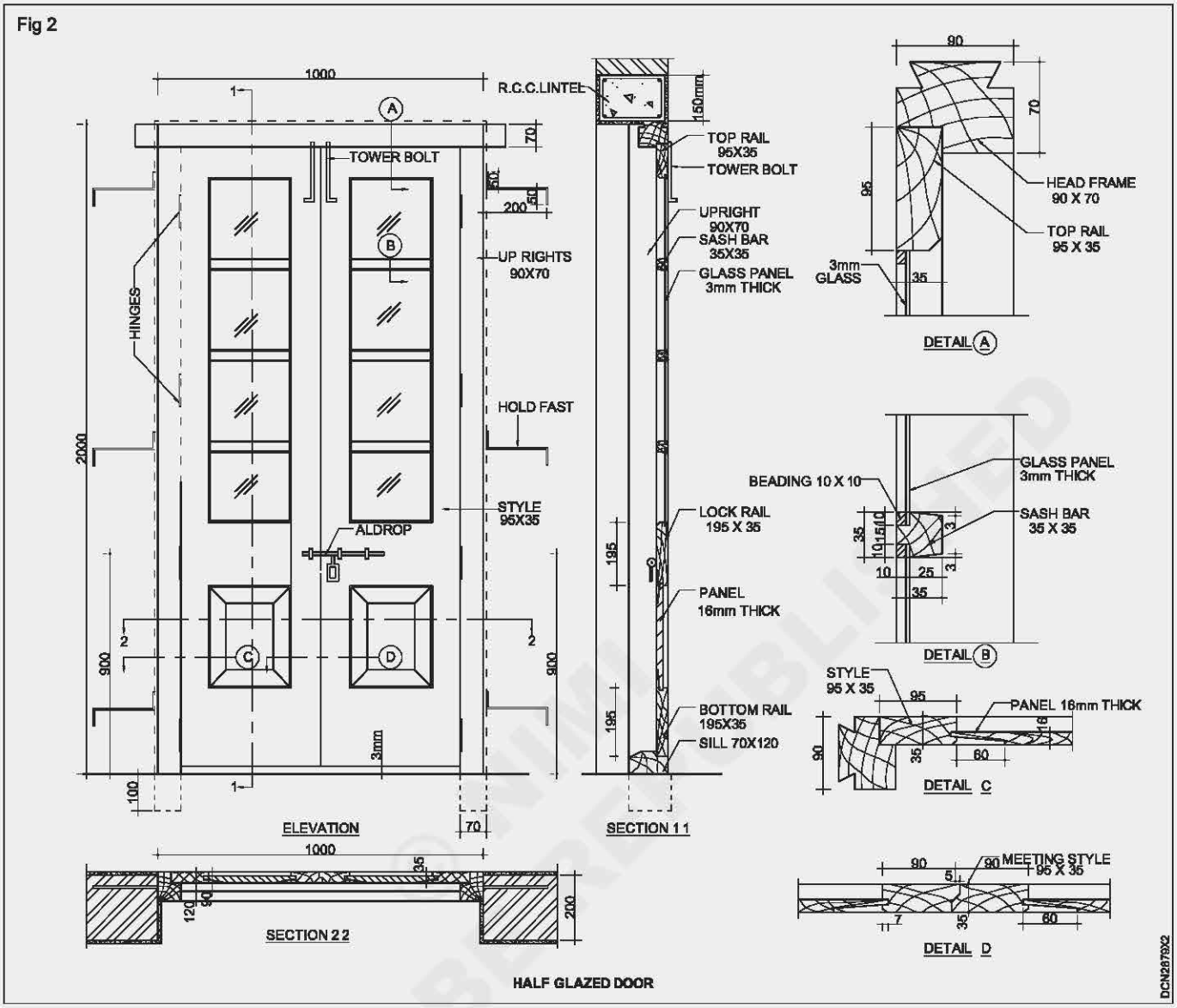
Glass = 3 mm thick 8 Nos.

Sash = 35 x 35 mm.

- Draw door opening 1000 x 2000 mm.
- Draw two posts 70 mm thick, height 1930 mm at a distance of 860 mm apart.
- Draw door head 70 mm thick and 230 mm long.
- Draw style of size 95 x 35 mm near the two post.
- Draw top rail 95 x 35 mm.
- Draw sash bar and glass panel as shown in figure.
- Draw the lock rail and mark the aldrop.
- Develop the vertical section mark the symbols and complete the drawing.

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Fig 2



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Types of doors - III

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

- **draw the section and elevation of the flush doors**
- **draw the elevation of collapsible door.**

TASK 1: **Draw the elevation and section of solid or laminated flush door (Fig 1a)**

DATA

Size of door	- 1000 x 2000.
Post	- 80 x 120 mm - 2 Nos.
Head	- 80 x 120 mm.
3 ply	- 6 mm thick.

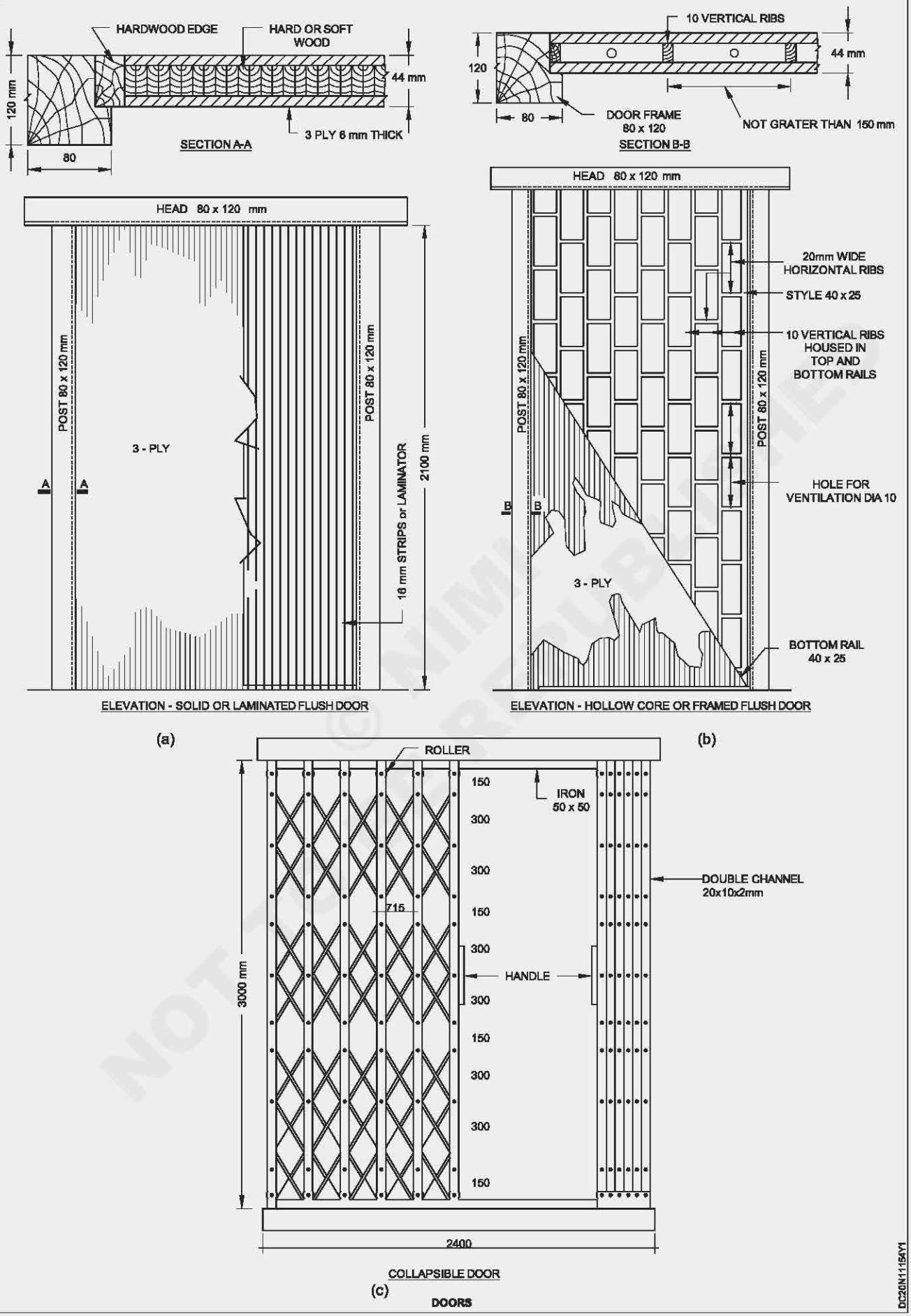
Thickness of shutter 44 mm.

- Draw the door opening, size of 1000 x 2100 mm.
- Draw two posts of thickness 80 mm, and height 1920 mm at a distance of 840 mm apart.
- Draw a head 80 mm thickness over the post.
- Draw parallel strips 16 mm each as shown in fig 1.
- Draw the details of section as shown in fig 1.
- Complete the drawing.

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Fig 1



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TASK 2: **Draw the elevation and section of framed flush door (Fig 1b)**

DATA

Horizontal ribs	- 20 mm wide.
Vertical ribs	- 10 mm.
Ventilaling hole	- 10 mm.
Bottom rail	- 40 x 25.

- Draw the door opening, 1000 x 2100 mm.
- Draw two points of thickness 80 mm, and height 1920 mm at a distance of 840 mm apart.
- Draw a head 80 mm thickness over the post.
- Draw horizontal & vertical ribs of 20 mm width as shown in fig 1.
- Draw bottom rail of size 40 x 25 mm.
- Draw the details of section as shown in figure.
- Complete the drawing.

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TASK 3: **Draw the elevation of collapsible door (Fig 1c)**

DATA

Size of door = 2400 x 3000 mm.

Double channels 20 x 10 x 2 mm.

Spacing of vertical channels 100 to 120 mm.

Flat iron 20 mm wide, 5 mm thick.

- Draw the door opening size 2400 x 3000 mm.
- Draw 10 vertical channels in open condition of left side and vertical channels in closed condition on right side.
- Draw the flats diagonally between the channels as shown in the figure. Mark the rivert heads at the junction of channels and plats.
- Complete the drawing.

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Types of windows & ventilator

Objectives: At the end of this exercise, you shall be able to
- **draw the elevation and vertical section of panelled windows**
- **draw the elevation and vertical section of steel windows**
- **draw the elevation and cross section of ventilators.**

PROCEDURE

TASK 1: **Draw elevation and vertical section of paneled window (Fig 1a)**

DATA	
Window opening	= 750 x 1200 mm.
Head	= 75 x 110 mm.
Post	= 75 x 110 mm - 2 Nos.
Hanging style	= 75 x 32 mm - Nos.
Meeting style	= 75 x 32 mm - Nos.
Top rail	= 75 x 32 mm.
Frieze rail	= 75 x 32 mm.
Bottom rail	= 75 x 32 mm.
Panel	= 348 x 162 x 20 mm - 6 Nos.
Projection of horn	= 150 mm on both sides.

- Draw the window opening of size 750 x 1200 mm.
- Draw two posts of 75 mm thick and 1050 mm height at distance of 600 mm apart.
- Draw a sill of 75 mm thick and 900 mm length below the post.
- Draw the head of 75 mm thick and 900 mm length over the post.
- Draw the hanging style of width 75 mm near the posts.
- Draw the two meeting styles of width 75 mm in the middle.
- Draw top rail and bottom rail of height 75 mm between the styles.
- Draw three panels of height of 258 mm and two free rail of 75 mm height between the top and bottom rail.
- Draw the vertical section as shown in fig 1.

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TASK 2: **Draw the elevation and details of glazed window (Fig 1b)**

DATA	
Window opening	= 750 x 1200 mm.
Head	= 75 x 110 mm.
Post	= 75 x 110 mm - 2 Nos.
Hanging style	= 75 x 32 mm - Nos.
Meeting style	= 75 x 32 mm - Nos.
Top rail	= 75 x 32 mm.
Frieze rail	= 75 x 32 mm.
Bottom rail	= 75 x 32 mm.
Panel	= 348 x 162 x 20 mm - 6 Nos.

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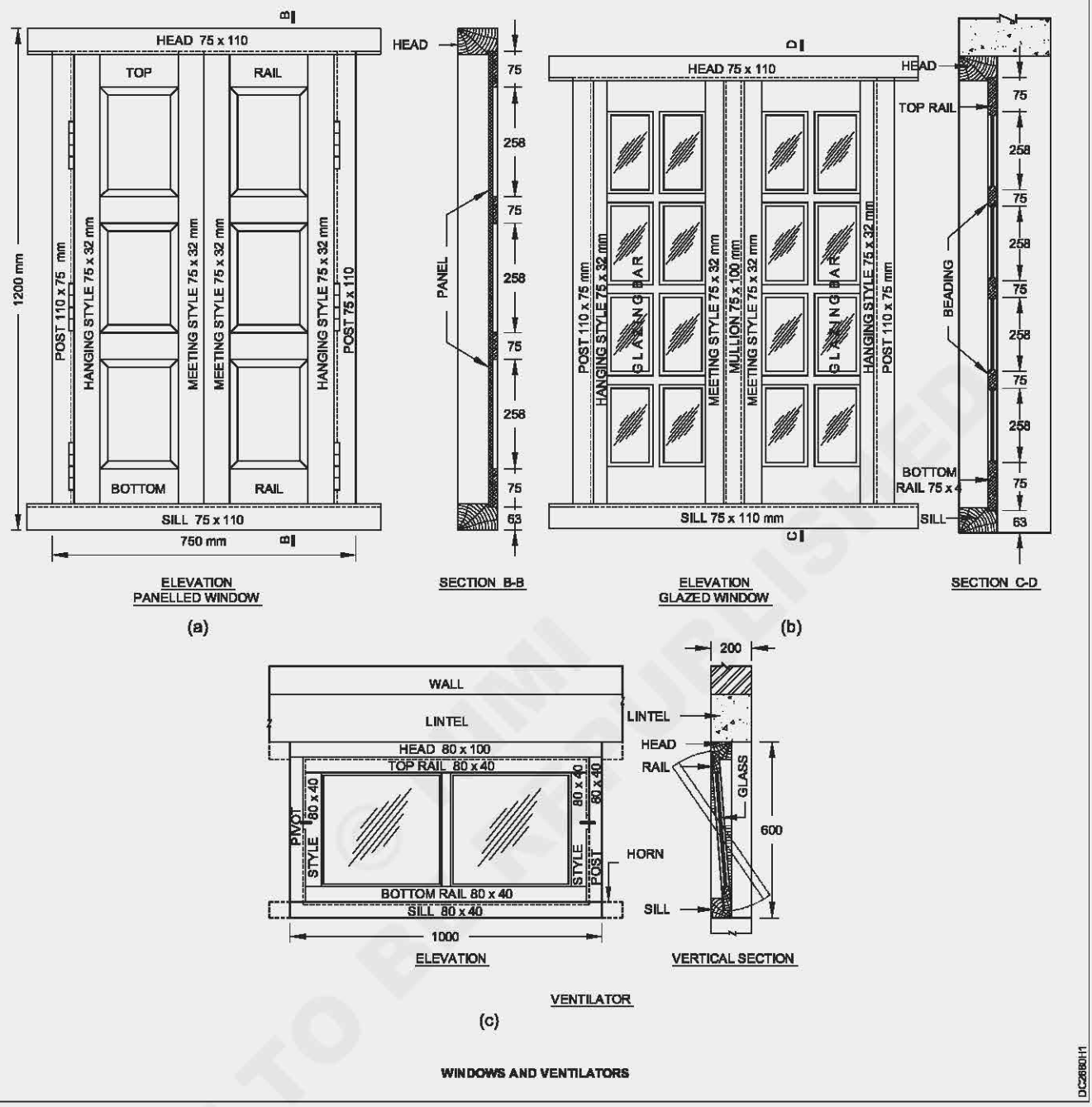
TASK 3: **Draw the elevation and cross section of ventilators (Fig 1c)**

DATA	
Size of ventilator	- 1000 x 600 m.
Head	- 80 x 100 mm.
Sill	- 80 x 40 mm.
Top rail	- 80 x 40 mm.
Bottom rail	- 80 x 40 mm.
Style	- 80 x 40 mm.

- Draw the an opening of size 1000 x 600 mm.
- Draw the posts of thickness 80 mm at a distance of 840 mm apart.
- Draw a sill of thickness 80 mm and length 1300 mm below the post.
- Draw a head of thickness 80 mm and length 1300 mm over the post.
- Draw two styles of 80 mm width near the post.
- Draw top and bottom rails of 80 mm width.
- Draw two glass panels.
- Complete the elevation as shown in fig.
- Draw the section of ventilator as shown in fig 1.
- Complete the drawing.

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Fig 1



Different types of windows

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

- **draw the different types of windows**
- **identify the location of windows.**

1 Draw bay window.

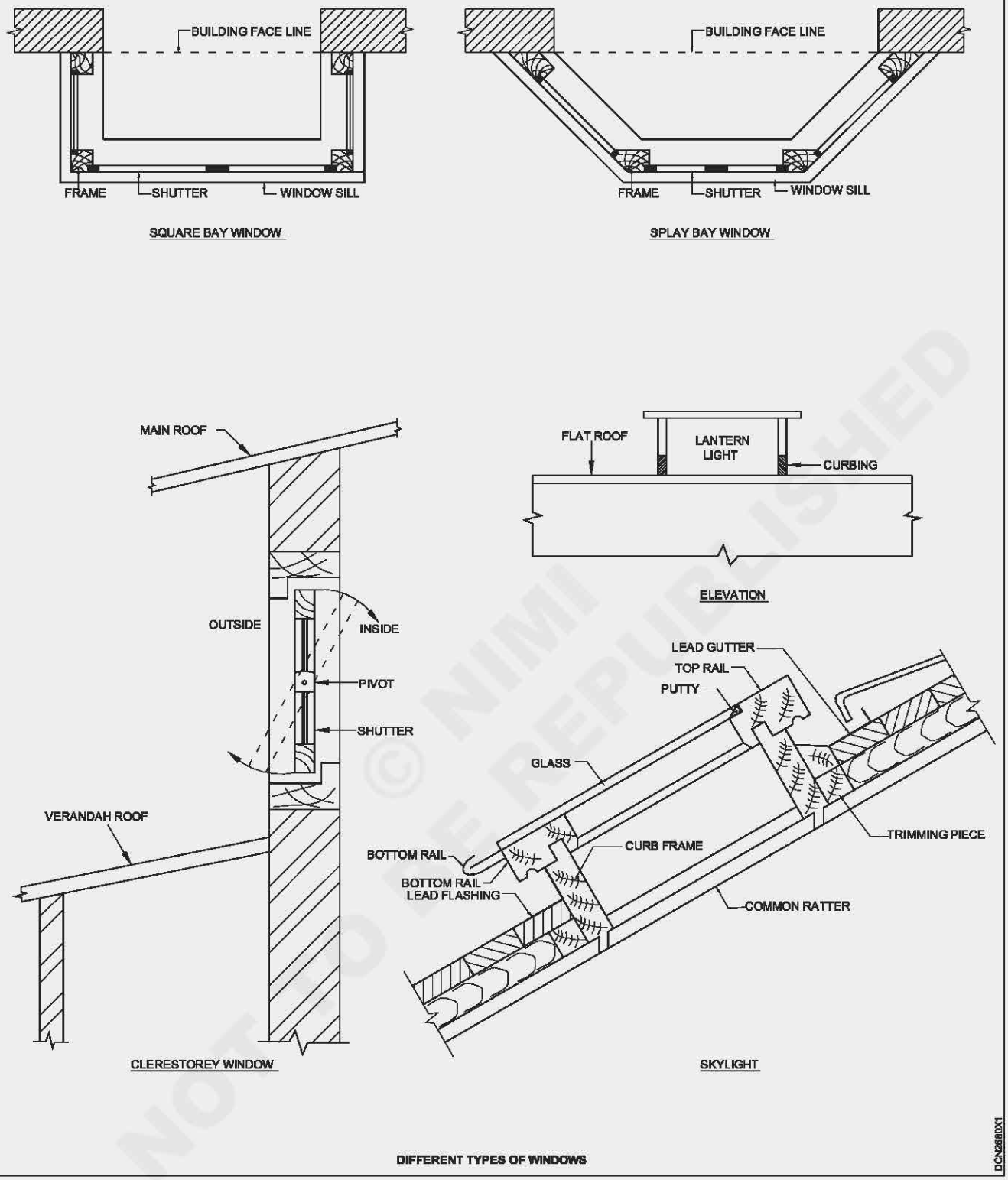
2 Draw corner window.

3 Draw clerestorey window.

4 Draw lantern light window.

5. Sky light window.

Fig 1



DIFFERENT TYPES OF WINDOWS

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Wiring diagram of a residential building

Objectives: At the end of this exercise you shall be able to
- **draw the wiring diagram of a building**
- **summarise the number of electrical points.**

DATA

Sizes of rooms are given in the plan.

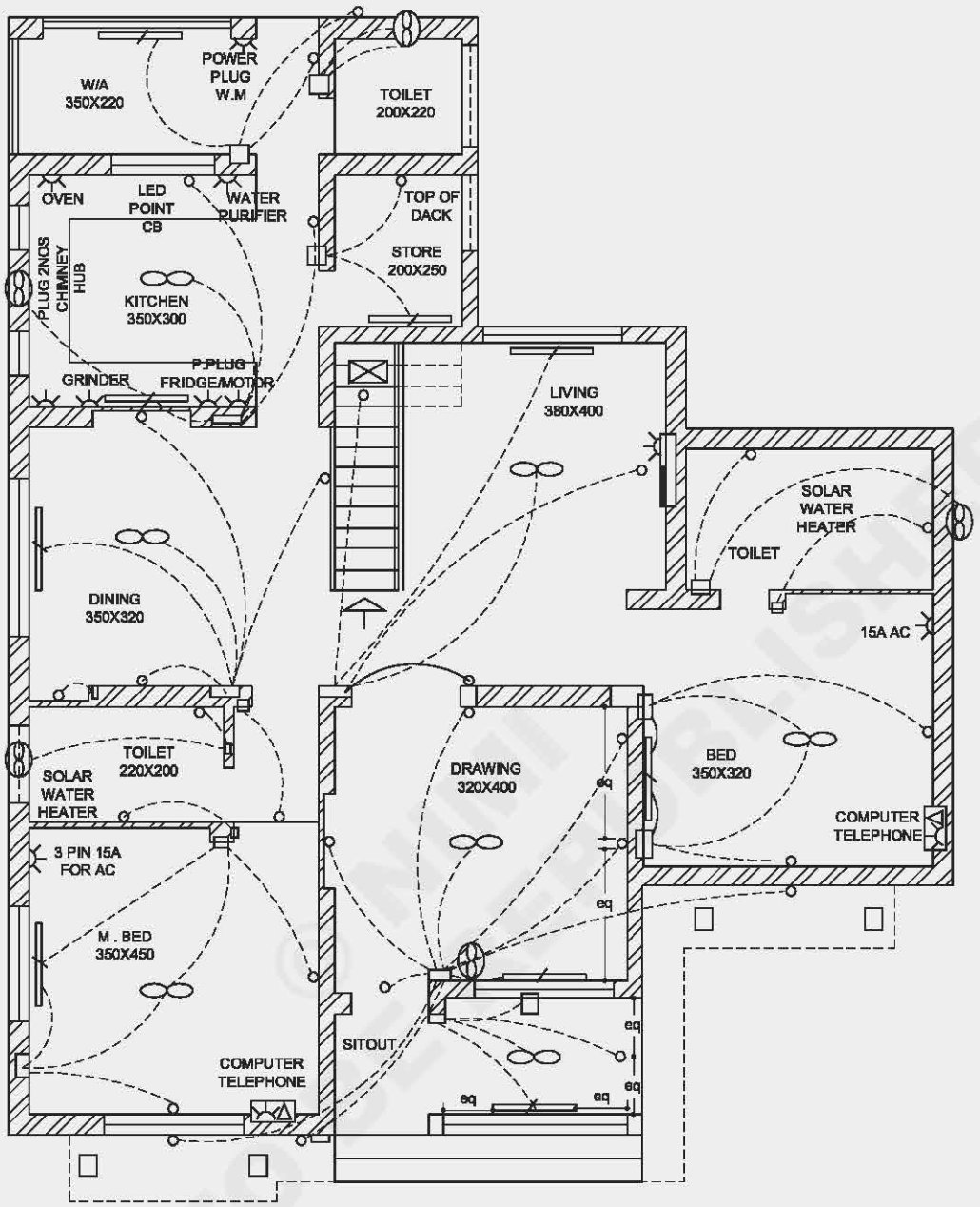
PROCEDURE

1 Draw the plans.

2 Draw the symbols of fittings. (Fig 1)

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Fig 1



LEGEND		
S. No.	PARTICULARS	SYMBOL
1	POWER POINT	
2	TUBE LIGHT	
3	SWITCH BOARD	
4	T.V. POINT	
5	TELEPHONE POINT	
6	CEILING FAN	
7	WALL FAN	
8	FANCY LIGHT	
9	EXHAUST FAN	
10	D.B.	
11	A.C. POWER PLUG	

WIRING DIAGRAM OF A RESIDENTIAL BUILDING

DCN2781H1

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Types of ground & upper floors

Objectives: At the end of this exercise, you shall be able to
- **draw section of a timber ground floor**
- **draw isometric view of brick floor**
- **draw isometric view of flag stone**
- **draw the section of concrete floor**
- **draw the section of terrazzo floor**
- **draw the section of mosaic floor.**

PROCEDURE

TASK 1**: Draw the section of a timber ground floor (Fig 1a)**

DATA

Wall	200 mm thick.
Base concrete	- 150 mm thick.
Sleeper walls	- 100 mm thicks, at 1500 mmc/c.
Wallplate	- 100 mm thick.
D.P.C	- 25 mm thick.
Bridging joint	- 50 x 180 mm.
Floor boards	- 32 mm thick.

- Draw the section of wall above and below ground floor.
- Draw the base concrete, 150 mm depth.
- Draw the sleeper wall of height 1000 mm at 1500 mm c/c.
- Draw the section of wall platel 100 mm x 100 mm, over 300 mm thick D.P.C on end wall and centre of sleeper wall.
- Draw the elevation of bridging joint 180 mm depth over these wall plates.
- Draw the section of floor boards, 32 mm thick over joint.
- Finish the drawing with proper conventional symbols.

— — — — — — — —

TASK 2**: Draw the isometric view of brick floors (Fig 1b)**

- Draw the sub-grade with 100 mm thick lean concrete as shown in figure.
- Draw 12 mm thick lime/ cement mortar over this subgrade.
- Draw the isometric view of bricks laid on edges as shown in figure.

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TASK 3**: Draw the isometric view of flag stone floor (Fig 1c)**

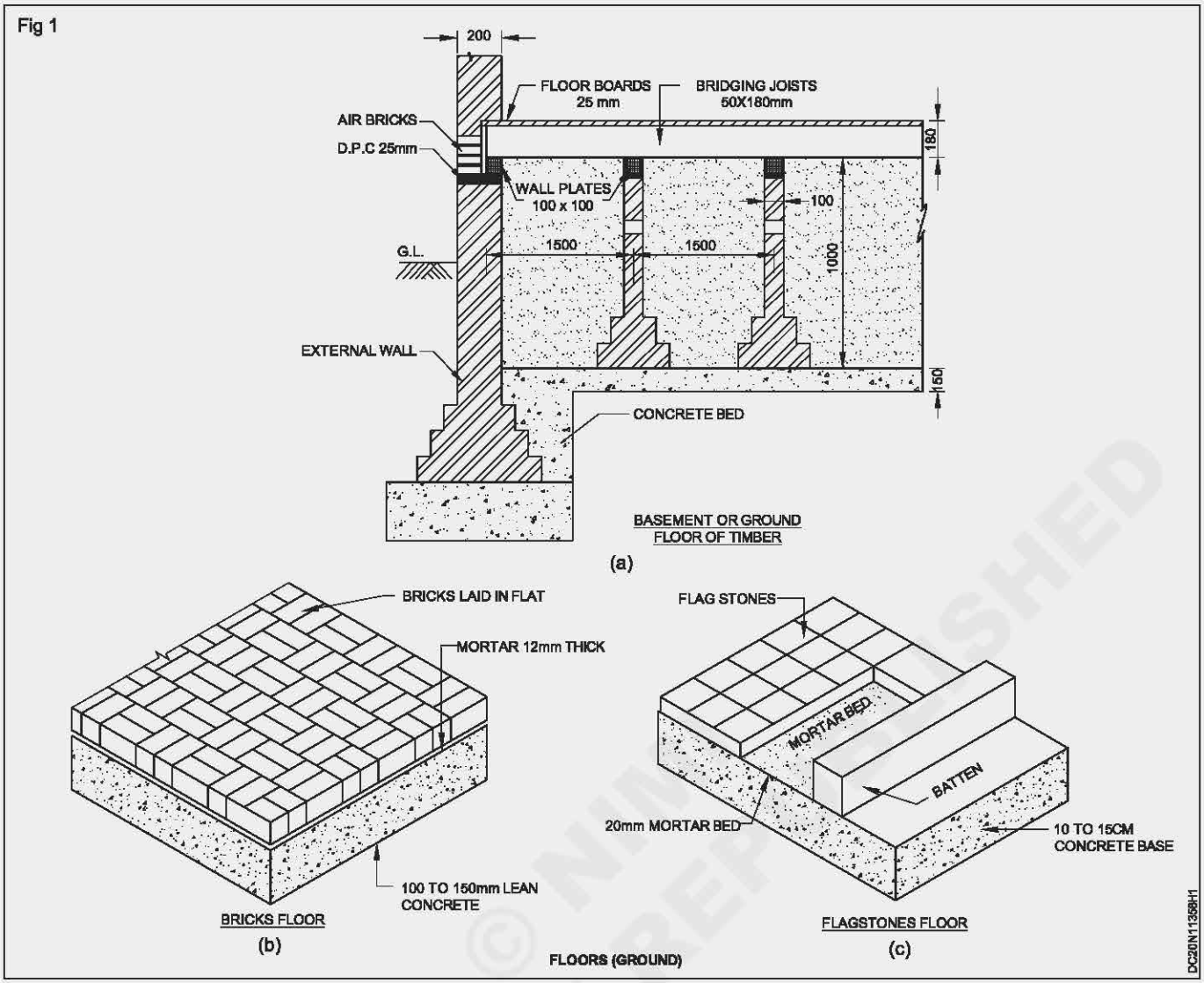
DATA

Stone size	- 60 x 45 x 20 mm.
Depth of concrete for subgragde	- 100 mm.
Mortar bed	- 20 mm thick.

- Draw the sub grade with 100 mm thick lean concrete as shown in figure.
- Draw 20 mm thick lime / cement mortar over this sub grade.
- Draw the stone slabs over this mortar bed as shown in figure.

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Fig 1



— — — — — — — —

TASK 4: **Draw the section of cement concrete floor (Dimensions are given in) (Fig 2a)**

- Draw section of a wall, with basement.
- Draw a line to mark to ground level.
- Show hard earth filling, of suitable (it may varies) thickness above ground level.
- Draw 100 mm thick base concrete above earth fill.
- Draw 25mm thick floor finish with cement plastering.

— — — — — — — —

TASK 5: **Draw the section of terrazzon floor (Fig 2b)**

- Draw section of a wall with basement.
- Draw a line to mark ground level.
- Show well consolidated earth fill above ground level.
- Draw 150 mm thick sand filling above earth fill.
- Draw 75 mm thick cement concrete over sand filling.
- Draw 34 mm thick cement mortar.
- Draw 6 mm thick terrzzo flooring.

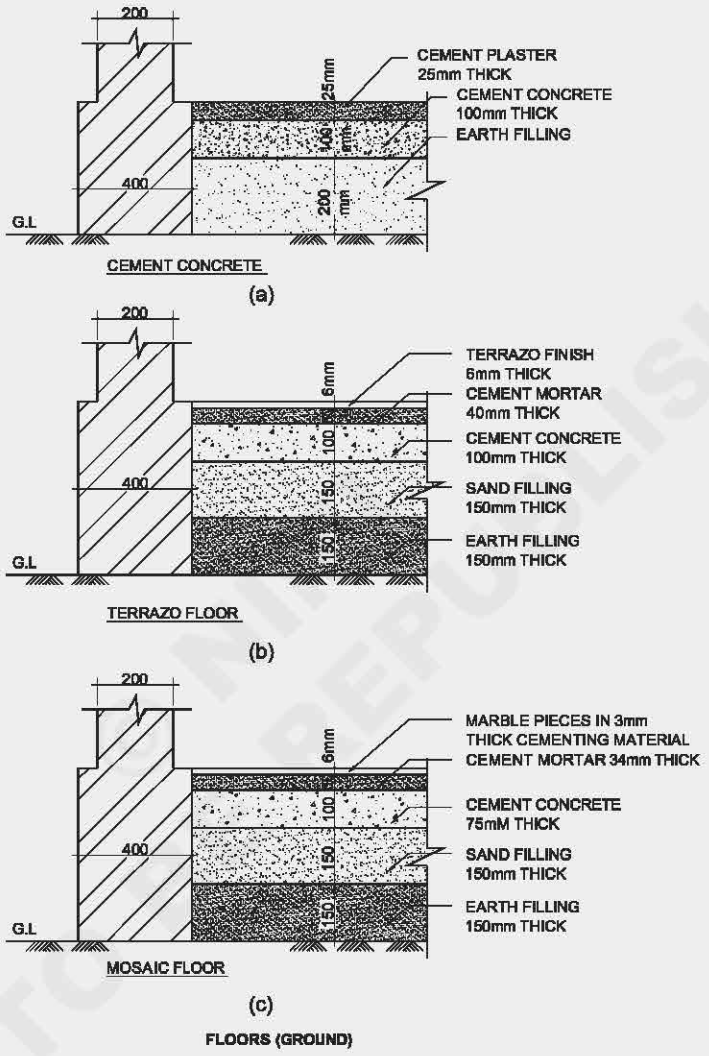
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TASK 6: **Draw the section of mosaic floor (Fig 2c)**

- Draw section of a wall with basement.
- Draw a line to mark ground level.
- Show well consolidated earth fill above ground level.
- Draw 150 mm thick sand filling above earth fill.
- Draw 75 mm thick cement concrete over sand filling.
- Draw 34 mm thick cement mortar.
- Show 6 mm thick marble chips is cementing materials, as mosaic flooring.

Fig 2



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Draw the types of upper floors

Objectives: At the end of this exercise, you shall be able to
- **draw plan and section of single joist timber floor**
- **draw plan and section of double joist timber floor**
- **draw plan and section of triple of framed timer floor**
- **draw the section of brick jack arch floor**
- **draw the section of concrete jack arch floor.**

PROCEDURE

TASK 1 **: Draw plan and detailed section of a single joist timber floor (Fig 1a)**

DATA

Room size	- 3000 x 4900 mm.
Wall	- 300 mm thick.
Bridging joist	- 50 x 100 mm at 350 mm c/c.
Herring bone strutting	- 32 x 50 mm.
Floor board	- 32 mm.
Wall plate	- 100 x 75 mm.
Wedge	- 75 x 100 mm.

- Draw the plan of the room 3000 x 1900 mm, width wall thickness 300 mm.
- Draw wall plate 100 mm wide on longer side, in dashed line.
- Draw 75 mm thick wedges on shorter walls.
- Draw the bridging joists, 50mm width at 350 mm c/c in shorter span.
- Draw 32 mm wide strut in the middle of shorter span and between the bridging joists.
- Show the boarding of 32 mm thick at one corner and complete the drawing as shown in figure.

— — — — — — — —

TASK 2**: To draw the section along long span (Section AA) (Fig 1b)**

- Draw the section of wall.
- Draw the wedge 75 mm wide and 100 mm height, attached to the wall.
- Draw bridging joists 50 mm wide, 100 mm depth, first one attached to the wedge and others, 350 mm c/c.
- Draw the struts 32 x 50 mm diagonally between the joists
- Draw the floor board 32 mm thick on the bridging joist.
- Draw the ceilling joining the bridging joist at bottom and complete the drawing.

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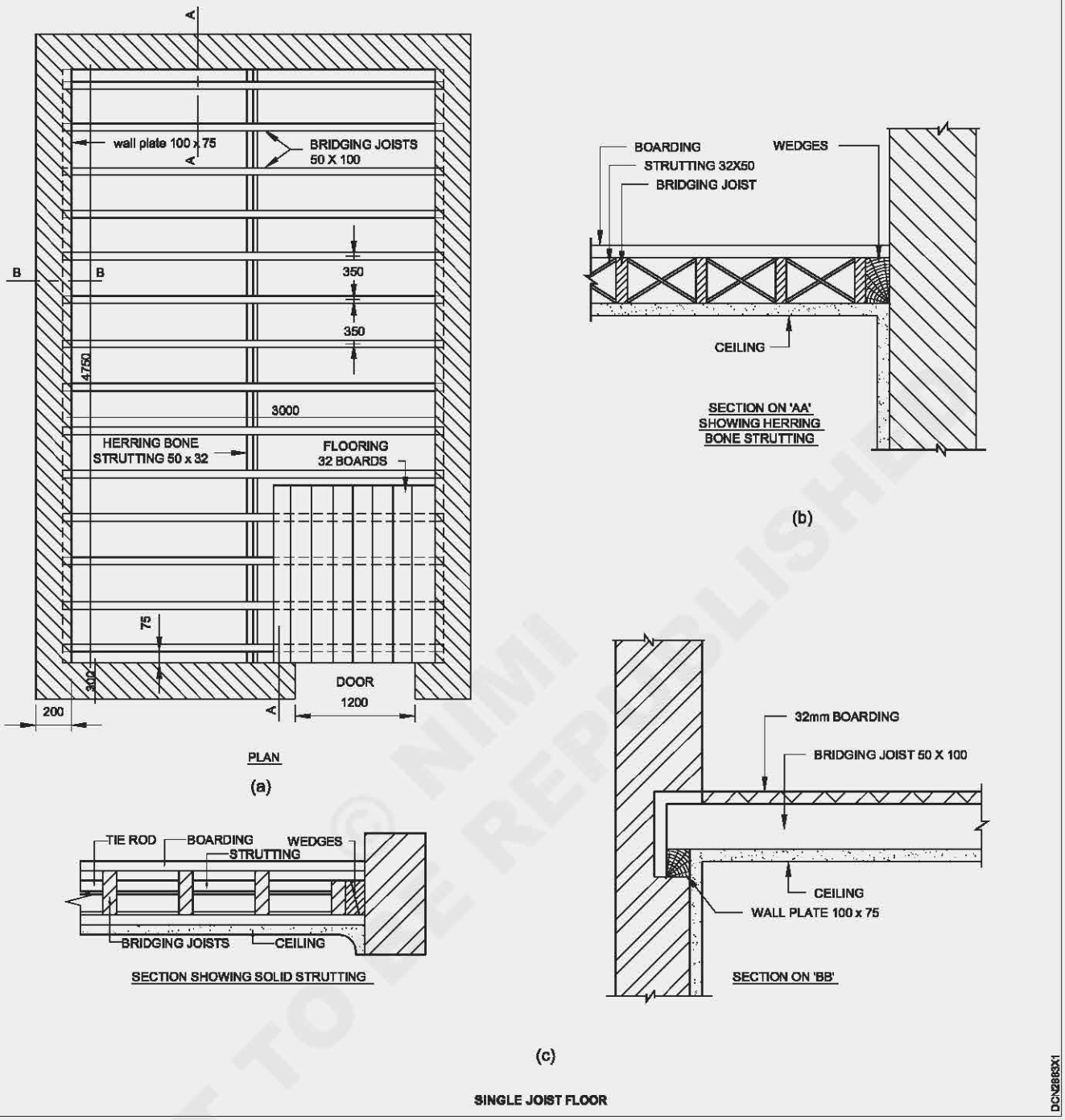
TASK 3**: To draw the section along shorter span (Section BB) (Fig 1c)**

- Draw the section of wall.
- Draw wall plate 75 mm wide, 100 mm height, inside the wall.
- Draw bridging joist 100 mm height over this wall plate.
- Draw a 32 mm thick board over the joist, starting from the side of wall.
- Show air space as shown in figure.
- Draw ceiling under the bridging joist, and complete the drawing.

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Fig 1



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TASK 4: **Draw the plan and detailed section of a double joist timber floor (Fig 2a)**

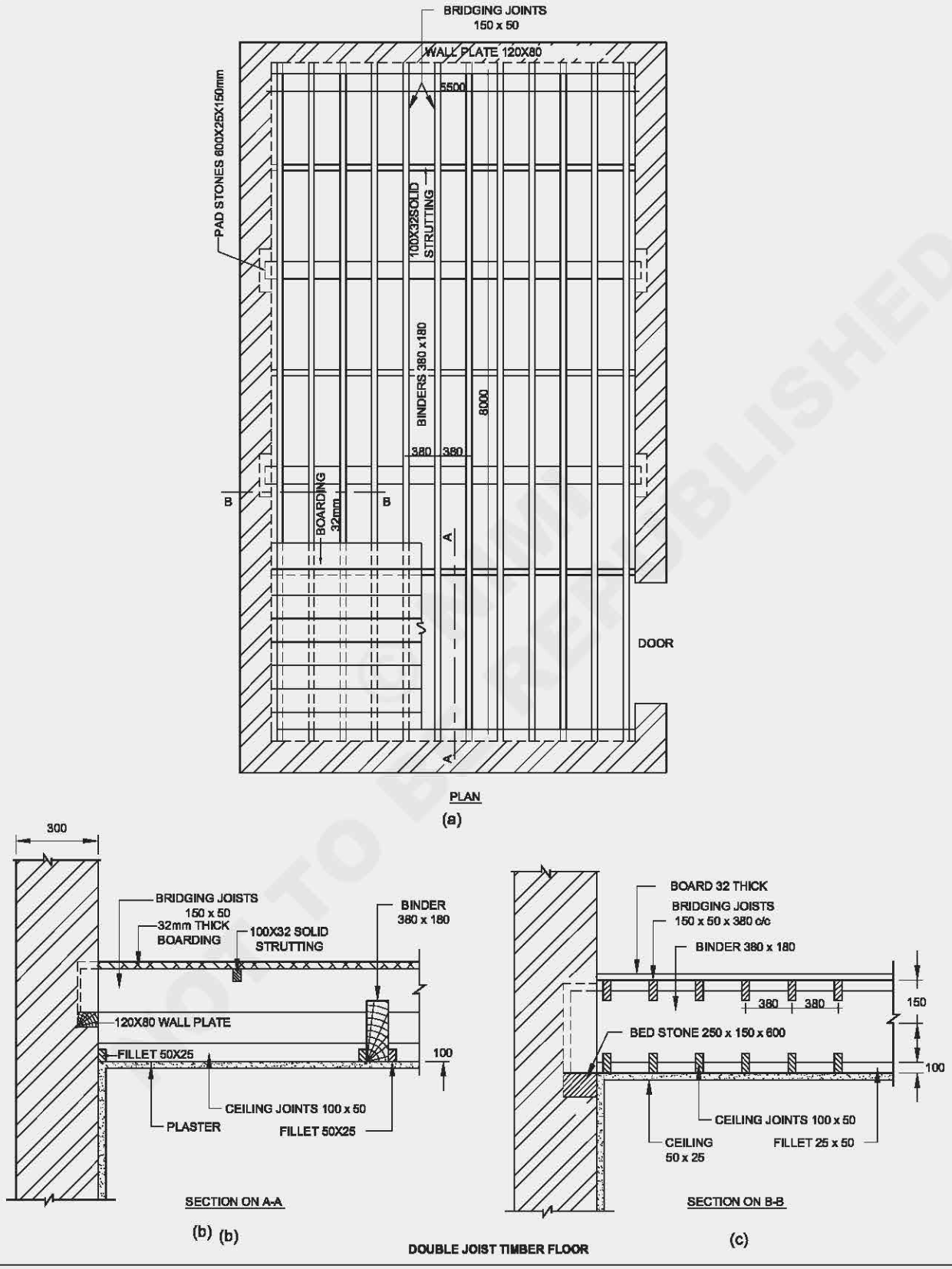
DATA

Wall thickness	- 300 mm.
Room size	- 5500 x 8000 mm.
Binders	- 180 x 380 mm at 2000 mm c/c.
Bed stone	- 250 x 120 x 600 mm.
Bridging joist	- 150 x 50 mm.
Struts	- 100 x 32 mm.
Boarding	- 32 mm thick.
Wall plate	- 120 x 80 mm.
Ceiling joist	- 50 x 100 mm.
Fillet	- 50 x 25 mm.

- To draw sectional plan.
- Draw sectional plan of room with all thickness 300 mm.
- Draw binders in shorter span, 2000 mm c/c.
- Draw bed stone 250 x 600 in the wall below the binders.
- Draw wall plate 75 mm inside the wall, in shorter span.

- Draw bridging joist 50 x 150 mm, 380 mm c/c along longer span.
- Draw the struts in between the bridging joist, in each span.
- Draw 32 mm thick boarding in one corner as shown in figure.

Fig 2



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TASK 5 : **To draw the section near the wall along long span (Section AA) (Fig 2b)**

- Draw the section of wall.
- Draw the ceiling joist, binders, bridging joist, board etc. as shown in figure.

— — — — — — — —

TASK 6: **To draw the section near the wall along short span (Section BB) (Fig 2c)**

- Draw the section of the wall.
- Draw the section of floor as shown in figure.

— — — — — — — —

TASK 7 : **To draw plan and section of triple joist timber floor (Fig 3)**

DATA

Bridging joist	- 7.5 x 15 cm.
Bider	- 28 x 15 cm.
Pad stone	- 25 x 12 x 60.
Struting	- 10 x 3.2 cm.
M.S Gider	- 38 x 10.5 cm.
Wall plate	- 12 x 8 cm.

- Draw a room of width 8 m. and suitable length with wall thickness of 300 mm.
- Draw wall plates size 12 x 8 cm on two sides as shown.
- Draw bridging joist of size 7.5 x 15 cm connecting the wall plate at 38 cm c/c.
- Draw M.S girder of size 38 x 10.5 cm at 3 m c/c.
- Draw pad stone of size 25 x 15 x 60 cm on left side wall with equal spacing.
- Draw binders of size 28 x 15 cm laid over the pad stone block.
- Draw wooden boarding 32 mm at left side corner.
- Draw wooden lines AA and BB as shown in figure.
- Draw section AA and BB as shown in figure.

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TASK 8: **Draw the section of brick jack arch floor (Fig 4a)**

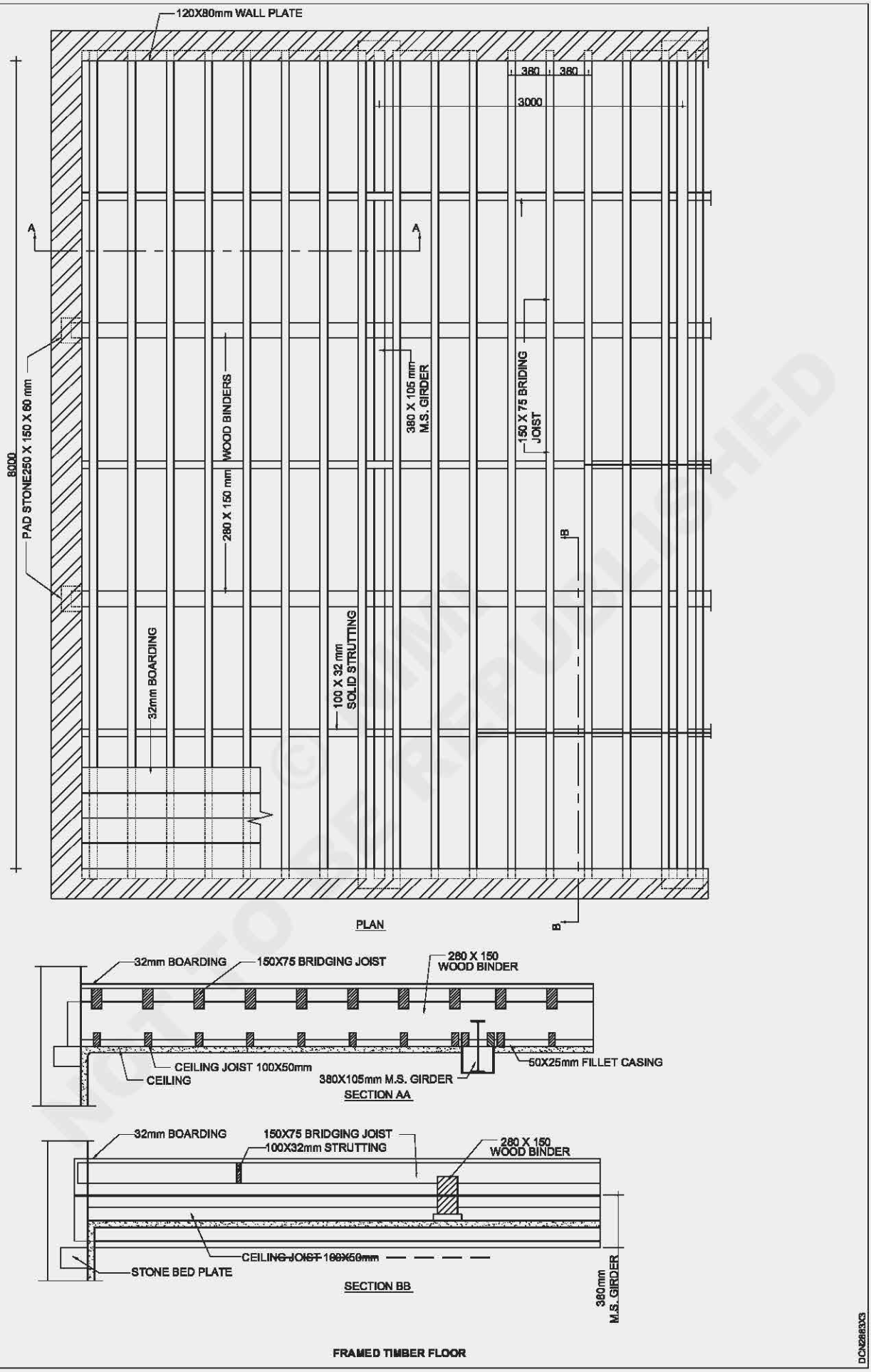
DATA

Span	- 1500 mm.
R.S.J	- 400 x 165 mm.
Tie rod	- 20 mm.

- Draw the section of wall 300 mm thick.
- Draw the R.S.J of size 400 x 165 mm in to the wall.
- Draw the second R.S.J at a distance of 1500 mm from the first R.S.J.
- Draw the arch joining the two bottom flangers as shown in figure 4a.
- Draw the brick on edge forming arch shape.
- Draw a tie rod connecting the two R.S.J.
- Draw a horizontal line 100 mm above the crown.
- Draw the title flooring showing 25 mm thick.
- Name and dimension the drawing.

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Fig 3



FRAMED TIMBER FLOOR

DCN2883X3

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TASK 9 : **Draw the section of concrete jack arch floor (Fig 4b)**

DATA

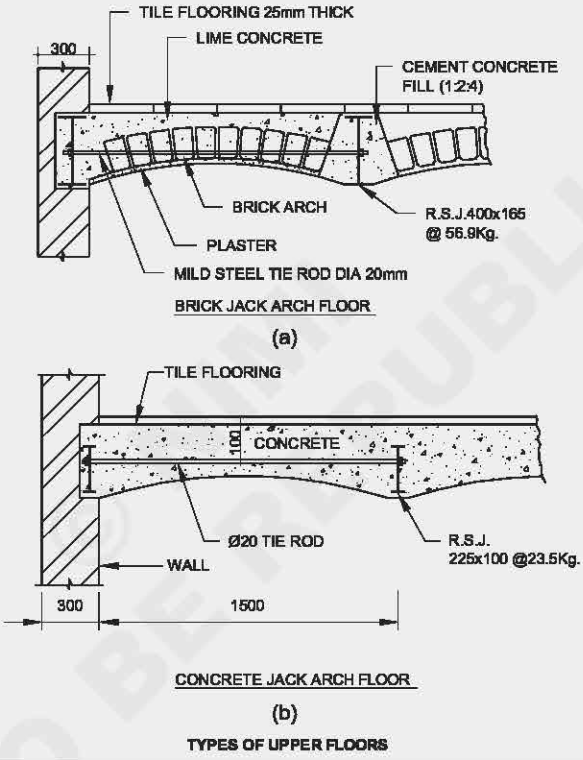
Span - 1500 mm.

R.S.J - 225 x 100 mm.

Tie rod - 20 mm.

- Arrange the position, in the layout for drawing details of concrete jack arch floor.
- Select the scale and draw the section of wall 300 mm thick.
- Draw the R.S.J of size 225 x 100 mm in to wall.
- Draw the second R.S.J at a distance of 1500 mm from the first R.S.J.
- Draw the arch joining the two bottom flanges as shown in figure.
- Show the concrete forming arch shape.
- Draw a tie rod connecting the two R.S.J.
- Draw a horizontal line 100 mm above the crown.
- Draw the tile flooring showing 25 mm thick.
- Name and dimension the drawing.

Fig 4



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Stairs (as per shape)

Objective : At the end of this exercise you shall be able to
- **draw the plan and section of straight stair.**

PROCEDURE

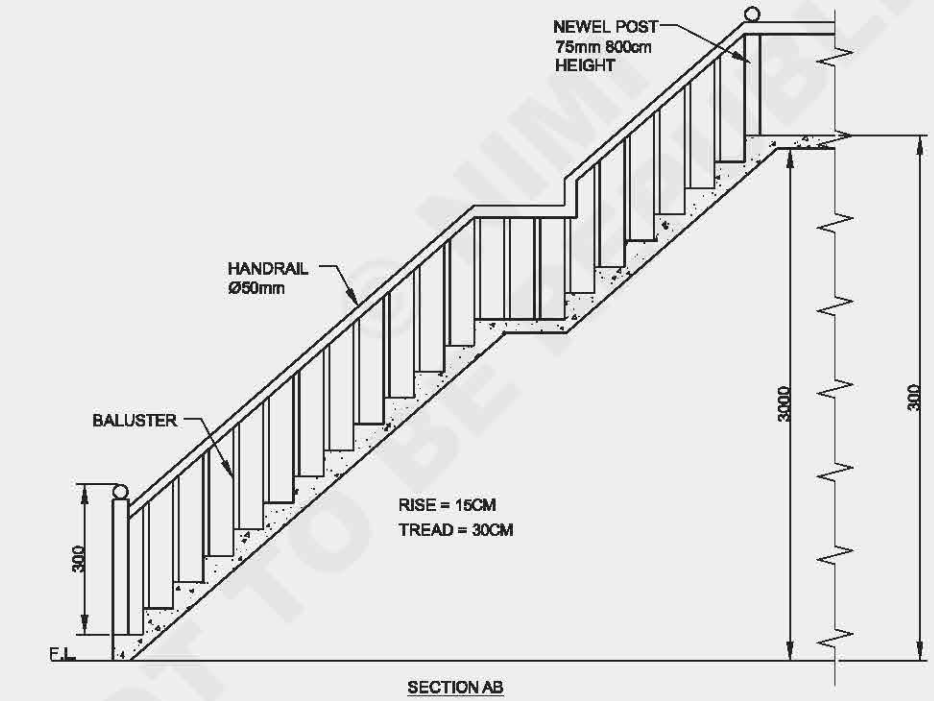
TASK 1: **Draw the plan and section of straight stair (Fig 1)**

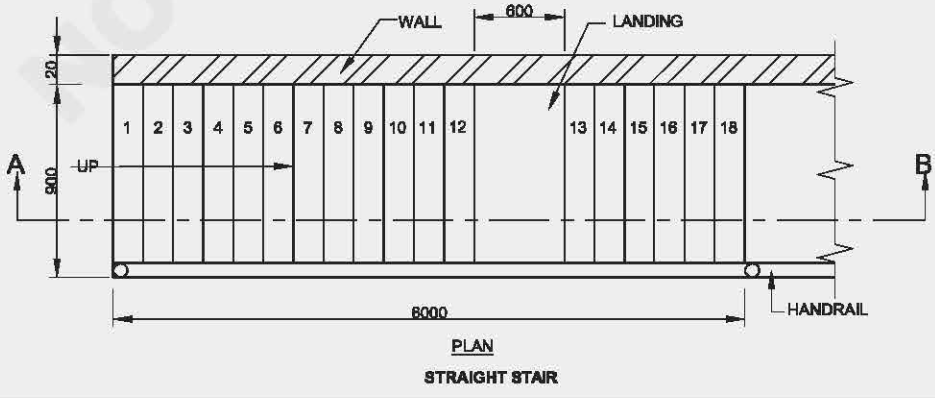
DATA

Height of upper floor	3m.
The total runs of straight stair	6m.
R.C.C waist	10cm thick.
The rise	15cm.
The Tread	30cm.
No. of Steps in the flight	= 20 Nos.
Width of stair	0.90m.
The handrail G.I pipe	50mm Dia.
Newel post G.I pipe	75mm 80cm height.

The baluster 25mm G.I pipe and missing data may be assumed.

Fig 1





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I PLAN

- Select scale 1:50.
- Draw plan of the straight stair with proper number of treads.
- Draw the landing after 12 thread.
- Draw the treads (6 Nos) after the landing.
- Dimension the drawing properly.

II Sectional Elevation

- Draw upward projector lines to mark the risers from each tread and complete the section as indicated in figures.
- Draw hand rail details.
- Fully dimension the drawing.

— — — — — — — —

Quarter turn newelstair

Objective : At the end of this exercise you shall be able to
- **draw the plan and section of quarter turn newelstair.**

TASK 1: **Draw the plan and section of quarter turn newelstair (Fig 1)**

DATA

Stair room size	= 3.4 x 4.3m.
Height of upper floor	= 315 cm.
Tread	= 30cm.
Rise	= 15 cm.
Width of landing	= 1m.
Width of stair	= 1m.
Wall thinkness	= 20cm.
R.C.C slab thickness	= 12 cm.
No.of risers 1st flight	= 13 Nos.
No.of risers 2nd flight	= 9 Nos.
Hand rail, newel post, baluster	= 25 mm.

I PLAN

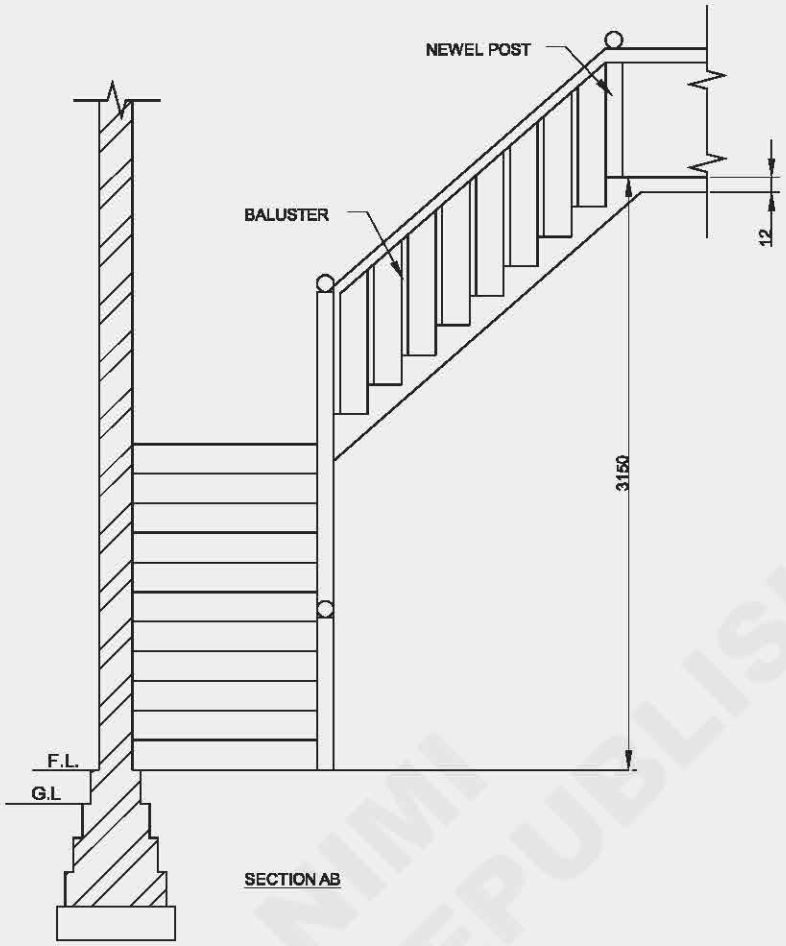
- Draw the plan of quarter turn newel stair as per given data with proper number of treads.
- Draw the landing after 12 risers.
- Draw the treads (8 Nos) after the landing on rightside.
- Draw the Hand rail in plan.

II Draw the elevation

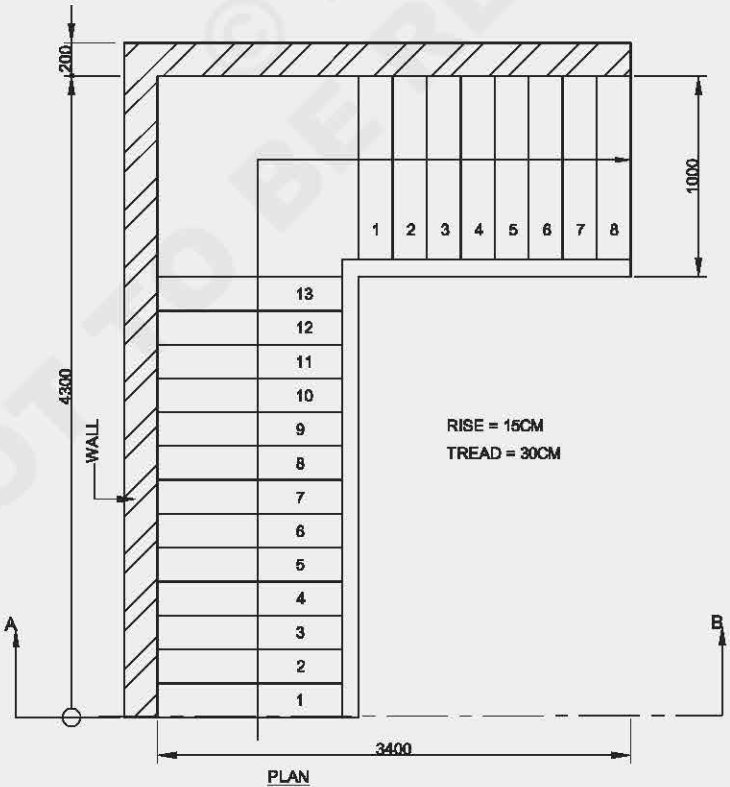
- Draw the projectors up ward from each tread to mark the risers.
- Draw the hand rail details as per the drawing.
- Dimension the drawing properly.

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Fig 1



SECTION AB



PLAN

STRAIGHT STAIR

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Half turn stair (geometrical)

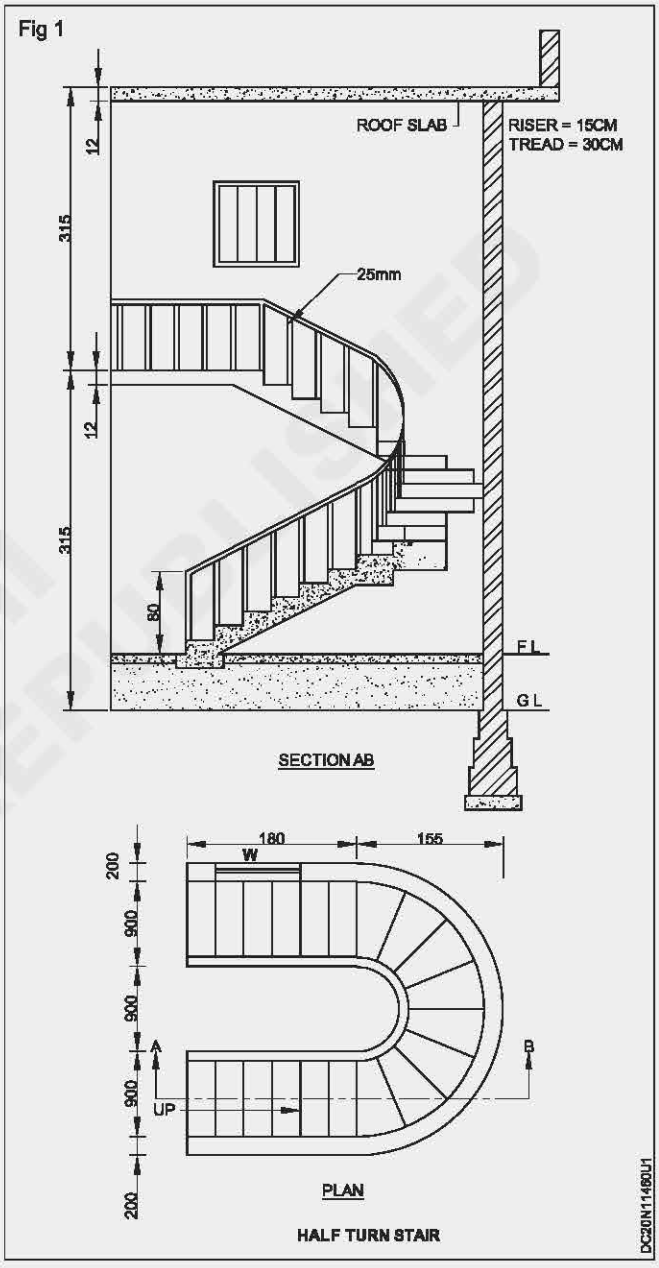
Objective : At the end of this exercise, you shall be able to,

- **draw the plan and section of half turn stair geometrical.**

TASK 1: **Draw the plan and section of half turn stair (geometrical) (Fig 1)**

DATA

Height between floors	= 315.
Tread	= 30cm.
Rise	= 15cm.
Width of stair	= 0.90m.
Open space	= 0.90m.
Wall thickness	= 20cm.
R.C.C slab thickness	= 12cm.
No.of tread	= 20.
No.of riser	= 21
Hand rail, newel post, baluster balustrade height	= 25 mm, =80cm.
Window style	= 1350 mm x 1450 mm.



PLAN

- Draw the plan of the stair room and treads as per given data.
- Draw the radiating treads from the centre.
- Draw handrail and window in plan.
- Complete the drawing with necessary dimensions.

ELEVATION

- Draw the upward projector lines from end of each tread to show the risers.
- Complete the drawing as per given data as shown in figure.
- Draw hand rail details as per data given.
- Draw elevation of the window.
- Dimension the drawing properly.

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Bifurcated stair

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

- **draw the plan and section of bifurcated stair.**

TASK 1**: Draw the plan and section of bifurcated stair (Fig 1)**

DATA

Height between floors	= 3m.
Tread	= 30cm.
Rise	= 15cm.

Landing = 106 X 1m.

Wall thickness = 20 cm.

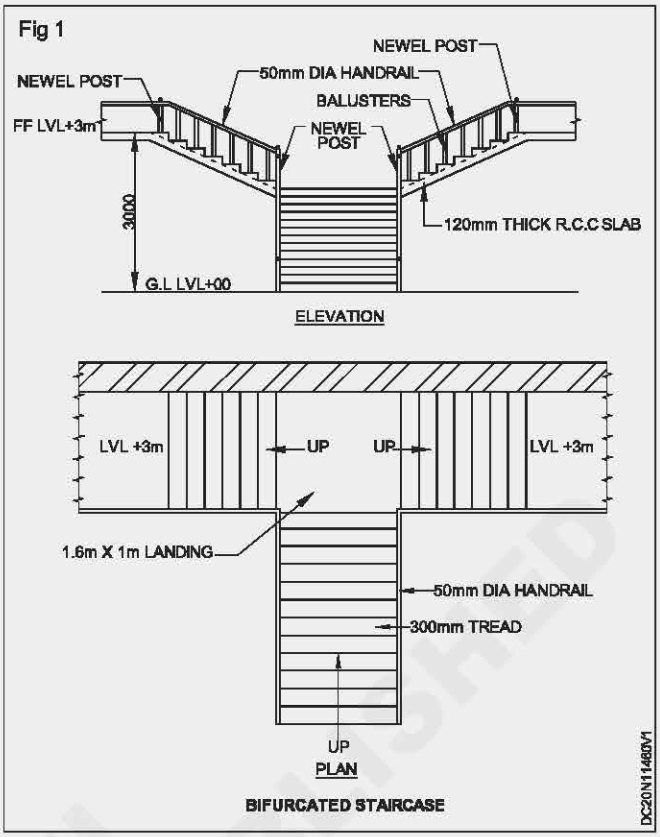
R.C.C slab thickness = 12 cm.

No.of risers in 1st flight = 12 Nos.

No.of risers in 2nd flight = 8 Nos.

Hand rail, newel post, baluster = 25 mm.

- Draw the plan of differential stair in 1:50 scale as per given data.
- To develop the elements, draw projections upwards form each tread.
- Complete the elevation as indicated in fig 1.



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Three quarter turn stairs

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

- **draw the plan and section of three quarter turn stairs.**

TASK 1: **Draw the plan and section of turn stairs. (Fig 1)**

DATA

Room size = 3.50 x 2.90m.

Wall = 30cm.

Height between floor = 3.00m.

Tread = 30 cm.

Rise = 15 cm.

Width of stair = 1.00m.

Width of stair = 1.00m.

Open well rectangle = 150 x 90 cm.

R.C.C. waist = 12.5 cm.

R.C.C. Beam = 20 x 25cm.

Nosing = 2.5 cm.

Hand rail = 50 mm.

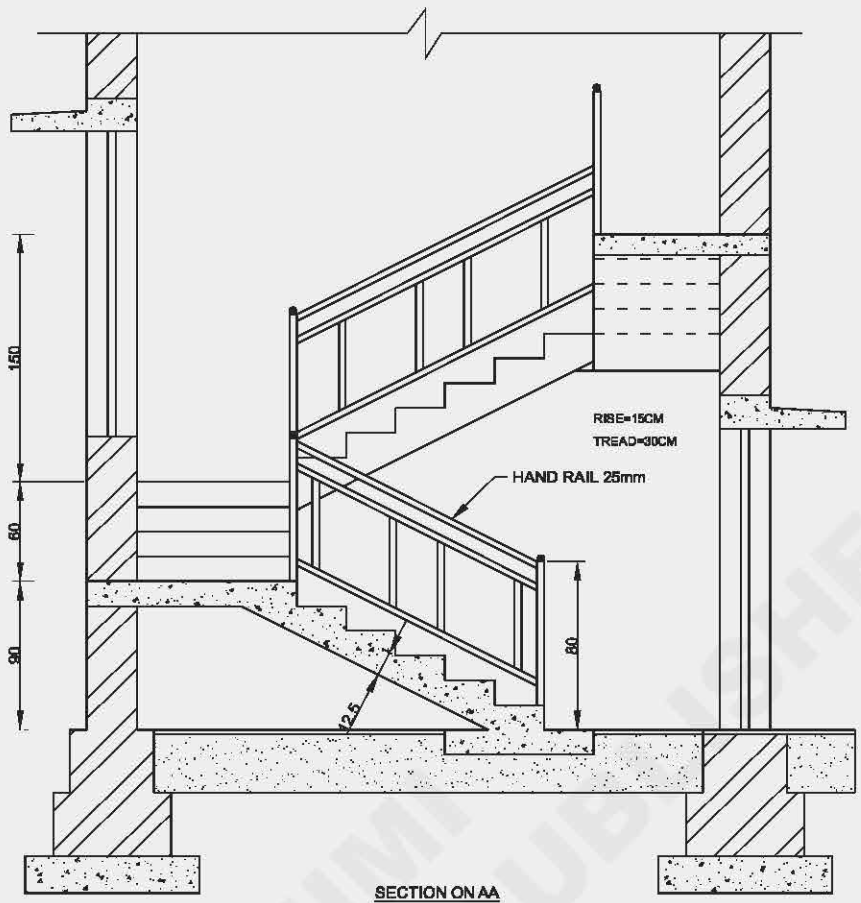
Baluster = 25mm, 80cm height.

Balustrade = with glass and wooden combination.

Same as previous exercise considering given data.

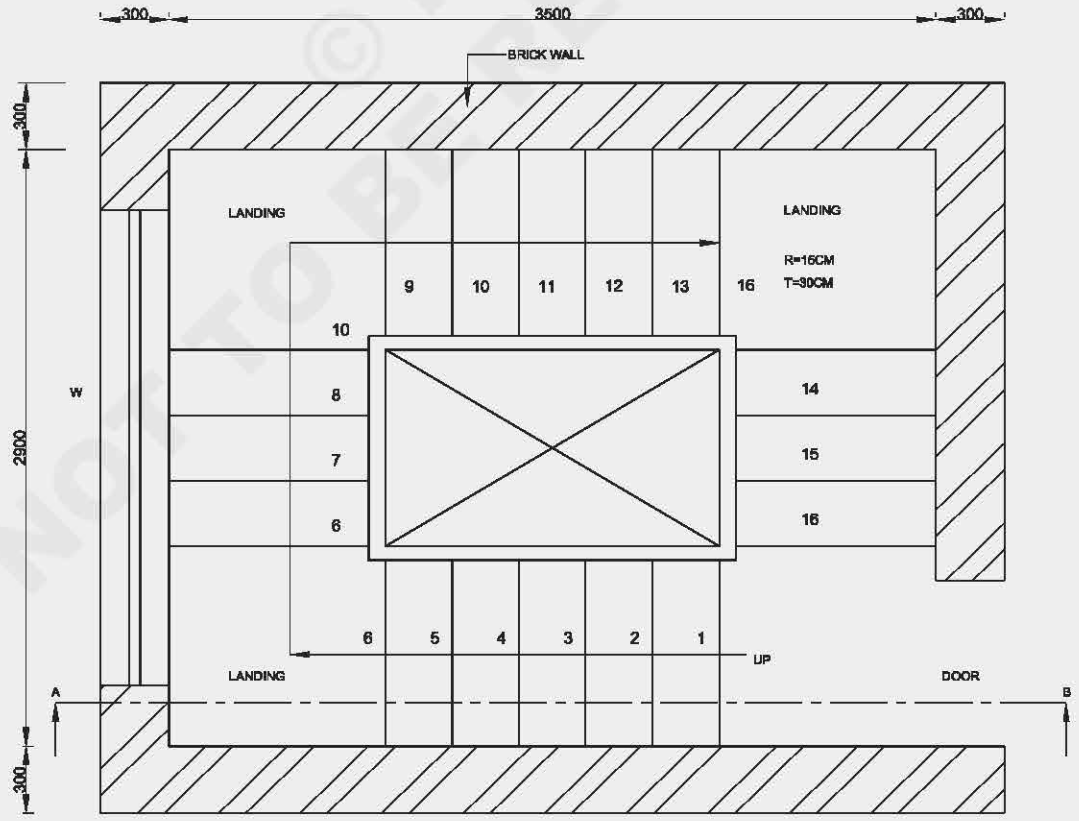
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Fig 1



SECTION ON AA

THREE QUARTER TURN OR "WIDE U"



PLAN

THREE QUARTER TURN OR "WIDE U"

DCN2865W1

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Spiral stair

Objective : At the end of this exercise, you shall be able to
- **draw the plan and section of spiral stairs.**

TASK 1**: Draw the plan and section of spiral stairs (Fig 1)**

DATA

Height of floor	= 3m.
Wall	= 30cm.
Tread	= 19cm inner circle and 56cm outer circle.
Rise	= 21.80cm.
Width of stair	= 0.80cm.
R.C.C Waist	= 12.5cm.
R.C.C Pilar	= 20cm.
Hand rail	= 50mm.
Baluster	= 25mm.

- Draw the column dia 20cm.
- Draw the outer circle of 0.9m radius.
- Divide the circle in to 10 Equal parts.
- Draw the 10 Winders.
- Draw the outer circumference of handrail of 50mm.
- Draw the complete plan.
- Develop the elevation by projecting each and very points form plan as shown.
- Draw the balusters and handrail and complete the elevation.
- Complete the plan and elevation of spiral stair.

— — — — — — — —

Half turn stair R.C.C open well

Objective : At the end of this exercise, you shall be able to
- **draw the plan and section of halfturn stair RCC open well.**

TASK 1: **Draw the plan and section of halfturn stair RCC open well (Fig 1, Fig 2, & Fig 3)**

DATA

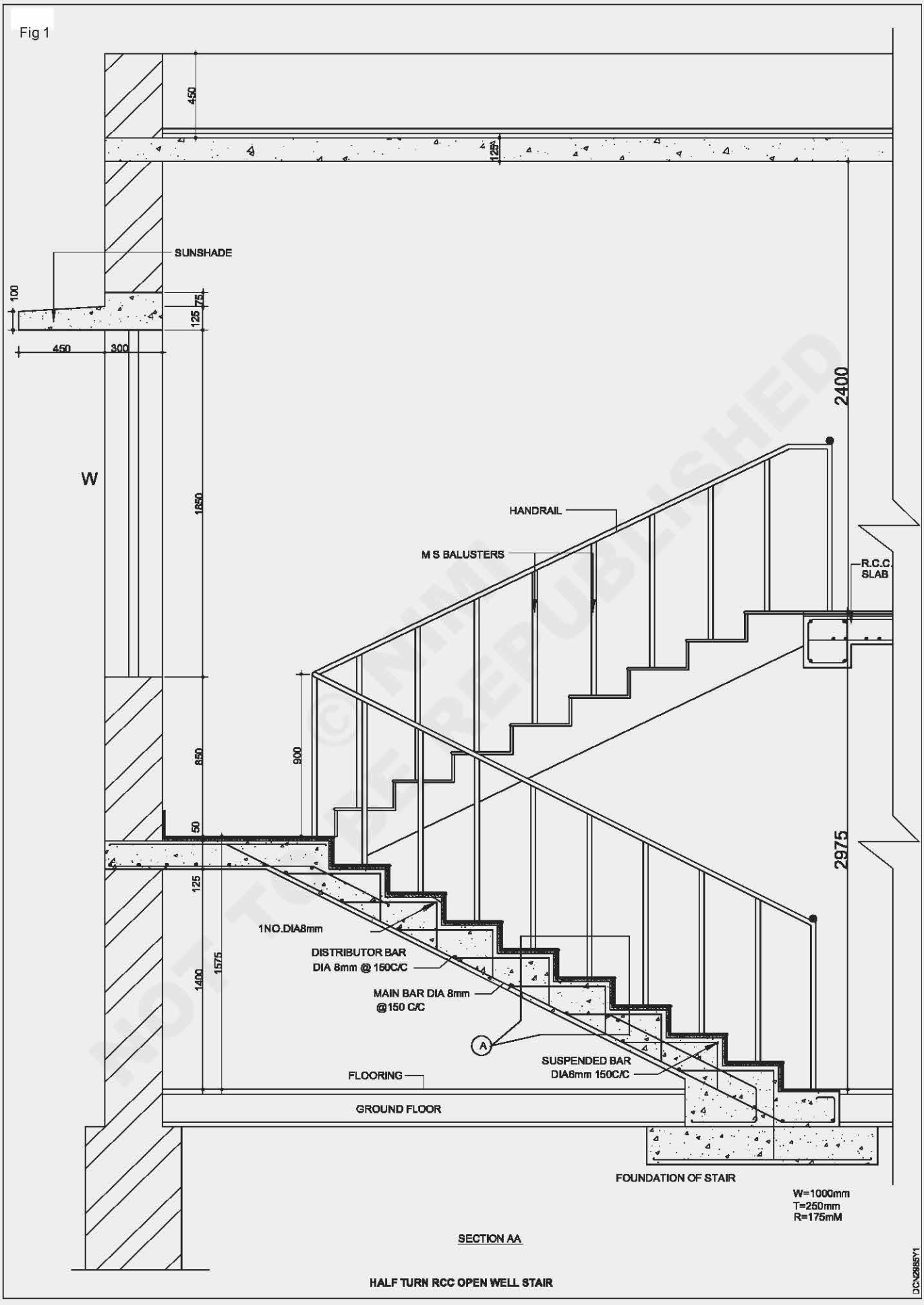
Room size	= 3 x 2.50m.
Wall	= 30 cm.
Height of floor	= 2.975 m.
Tread	= 25 cm.
Rise	= 17.5 cm.
Width of stair	= 1.00 m.
Width of landing	= 1.00 m.
Open well rectangle	= 50 cm width.
R.C.C waist	= 12.5 cm.
R.C.C Beam	= 20 x 25 cm.
Nosing	= 2.5cm.
Hand rail	= 50 mm.
Baluster	= 25 mm.

- Draw the plan of room with size 6 x 2.5m.
- Draw the width of stair as1 m.
- Draw the treads 25 cm wide and complete the plan as shown in figure.
- To develop the section, draw projectors upwards from each tread.
- Complete the section as indicated in the figure.

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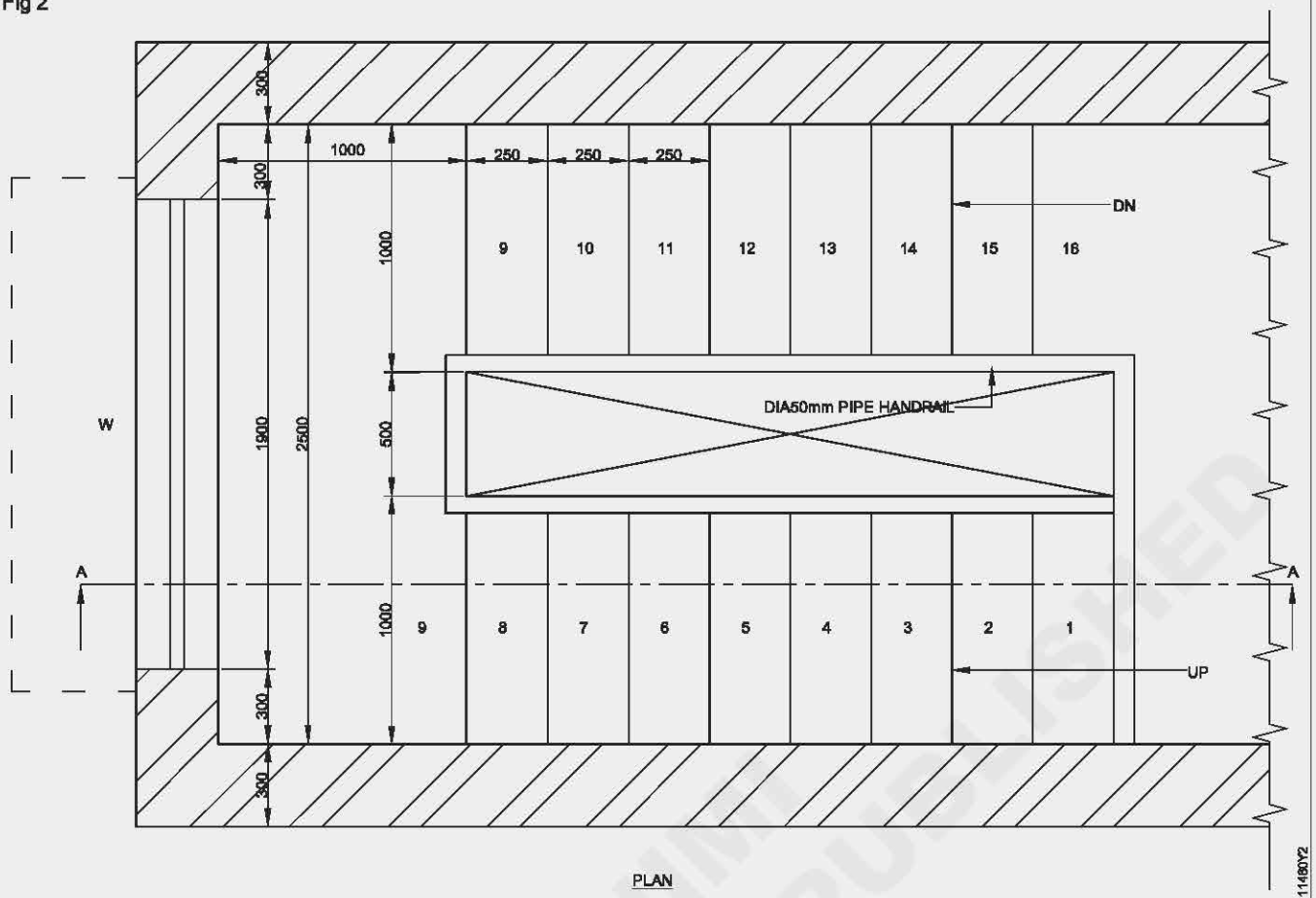
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Fig 1



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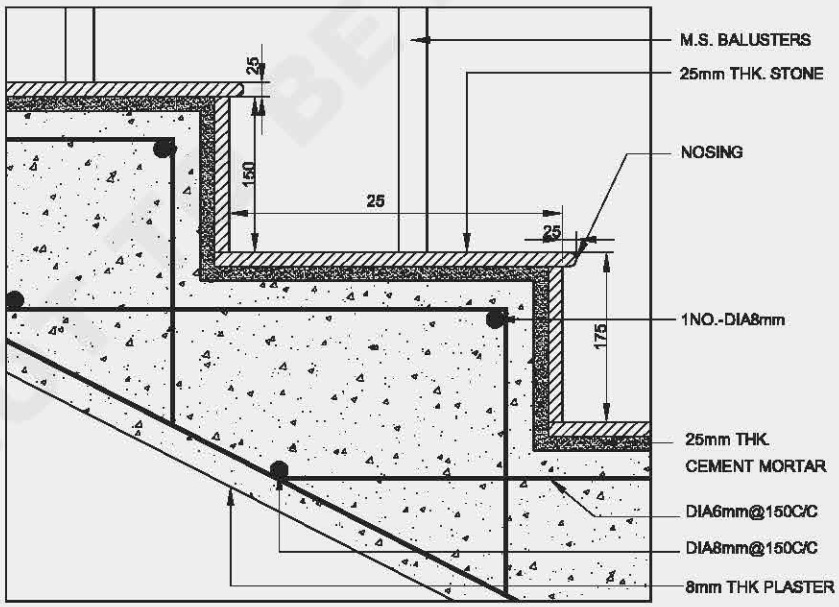
Fig 2



PLAN

HALF TURN RCC OPEN WELL STAIR

Fig 3



DETAIL A

HALF TURN RCC OPEN WELL STAIR

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Brick stair

Objective : At the end of this exercise you shall be able to
- **draw the plain and section of brick stair.**

PROCEDURE

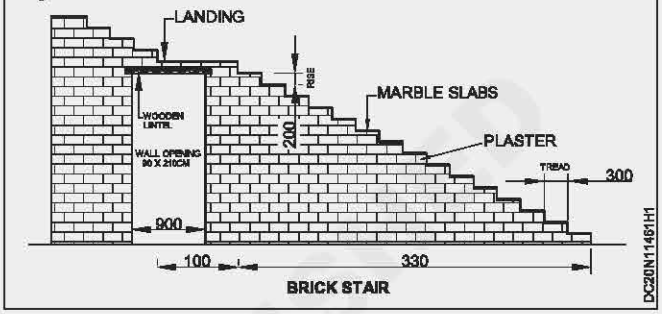
TASK 1: **Draw the plan and section of brick stair (Fig 1)**

DATA

Tread = 0.30m.
Wall = 30cm.
No.of riser in 1st flight = 15 nos.
Size of opening below the landing = 0.90 x 2.10m.
Wooden lintel = 0.30 x 0.10 cm.

- Draw the elevation of stretcher course of a solid wall as shown.
- Draw an opening as shown.

Fig 1



- Draw a lintel over opening as shown and complete the drawing as shown.

Stone Stair

Objective : At the end of this exercise, you shall be able to
- **draw the plan and section of stone stair.**

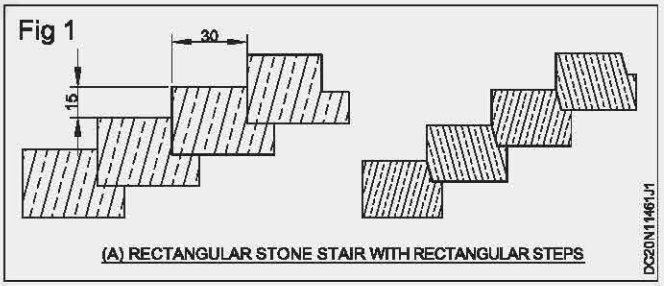
TASK 1: **Draw the section of staright flight stone stair composed of rectangular steps both ends resting on walls**

DATA

Rise = 15 cm.
Going = 30 cm.

- Draw tread 30 cm wide.
- Draw rise 15 cm.
- Draw the stone stairs with rectangular steps and complete the figure as shown in figure. (Fig 1)

Fig 1



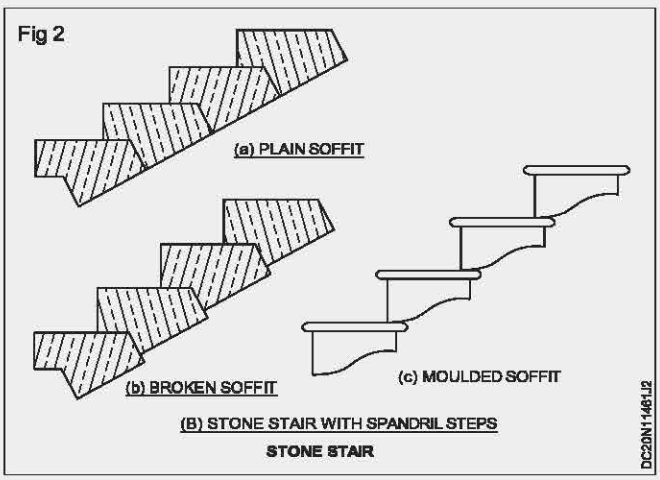
TASK 2 : **Draw the section of staright flight stone stair composed of spandril steps both ends resting on walls.**

DATA

Rise = 15 cm.
Going = 30 cm.

- Draw the stair with spandril steps with plan soffit, broken soffit and moulded soffit.
- Complete the drawing as in figure. (Fig 2)

Fig 2



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Wooden stair

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

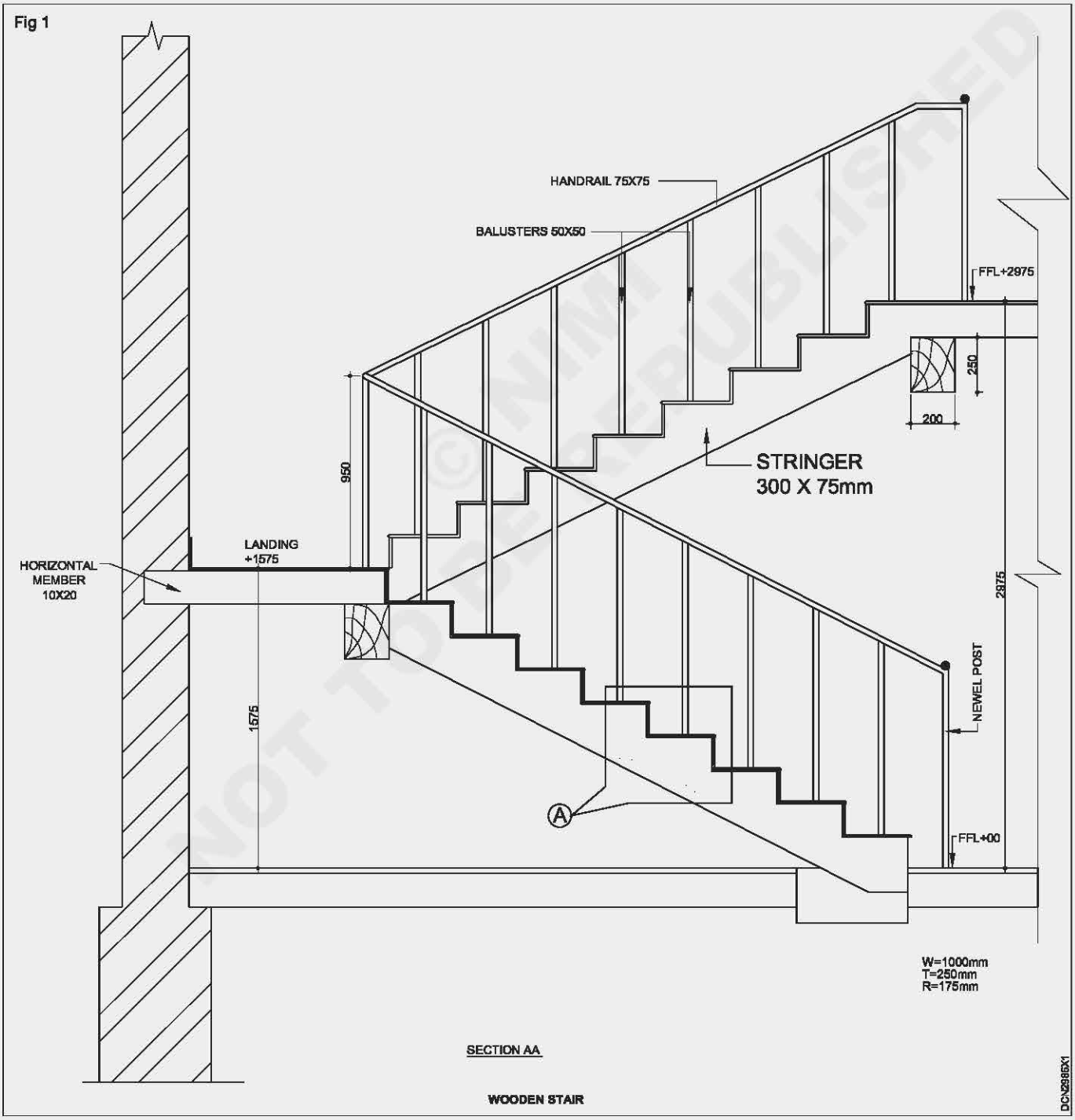
- **draw the plain and section of wooden stair.**

TASK 1 : **Draw the plan and section of wooden stairs (Fig 1, 2 & 3)**

DATA

Room Size	= 3.00 x 2.50m.	Rise	= 17.5cm.
Wall	= 30 cm.	Width of stair	= 1.00m.
Height of upper floor	= 3.15m.	Plank	= 12.5cm.
Tread	= 25cm.	Nosing	= 2.5cm.
		Hand rail	= 50mm.

Fig 1



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Baluster	= 25mm.	Horizontal member	= 10 x 20cm.
Width of landing	= 1m.	Wooden beam	= 20 x 25cm.
Open well space	= 50cm. (rectangle)	Complete the drawing showing all details as shown in figures.	
Stringer beam	= 10 x 20cm.		

Fig 2

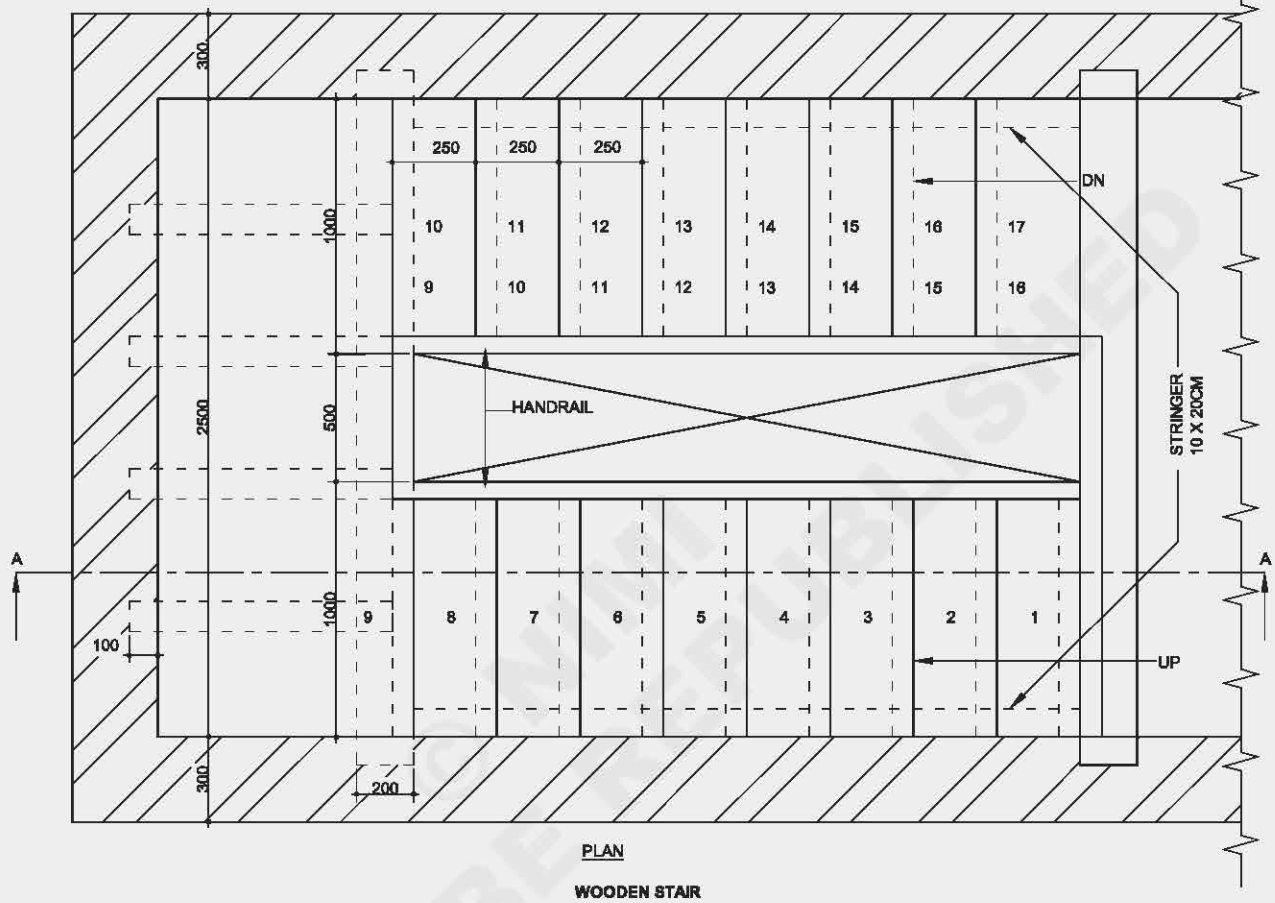
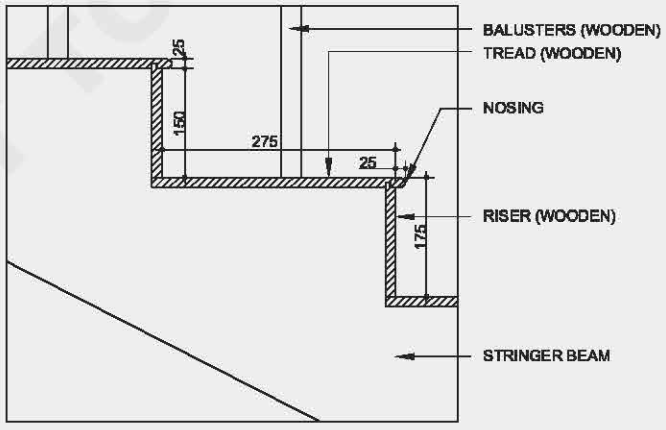


Fig 3



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Metal stair

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

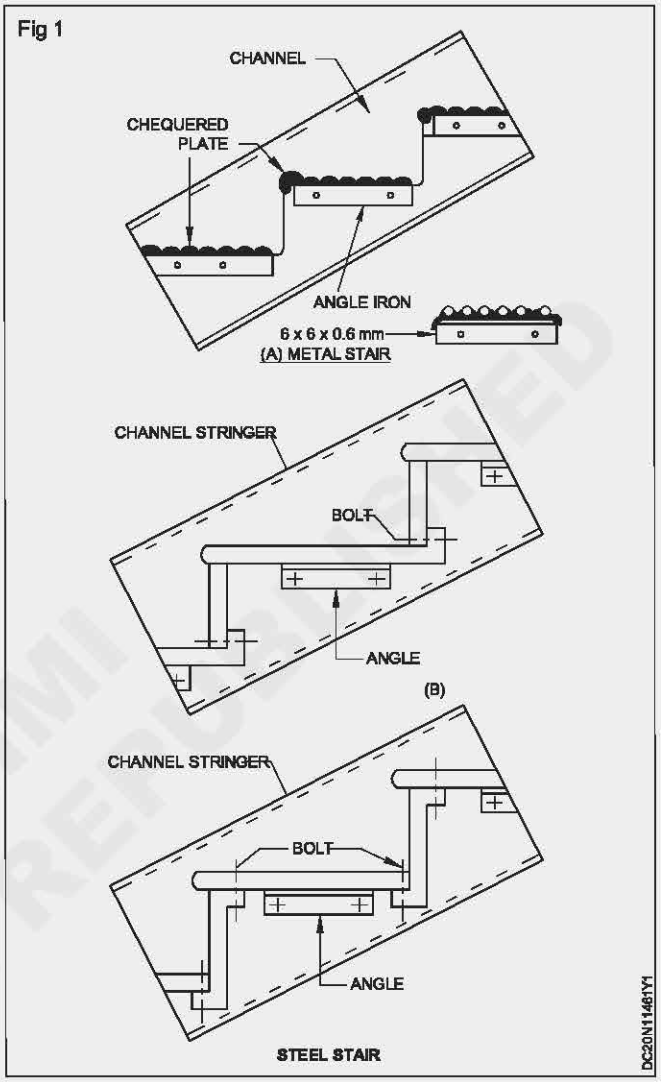
- **draw the section of metal stair**.

TASK 1 : **Draw the section of metal stairs (Fig 1)**

Rise	= 15cm.
Tread	= 30cm.
Two side channel stringer ISA	= 150 x 150 x 12mm.
Angle iron	= 6 x 6 x 0.6mm.
Chequered plate	= 6 x 6 x 0.4mm.

- Draw two side channel stringer.
- Draw tread and rise angle plate and fittings fasterning nut, bolt, weld, etc.
- Complete the plan and section as given in figure.

Fig 1



Half turn stair R.C.C dog legged

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

- **draw the plan and section of halfturn stair R.C.C dog legged.**

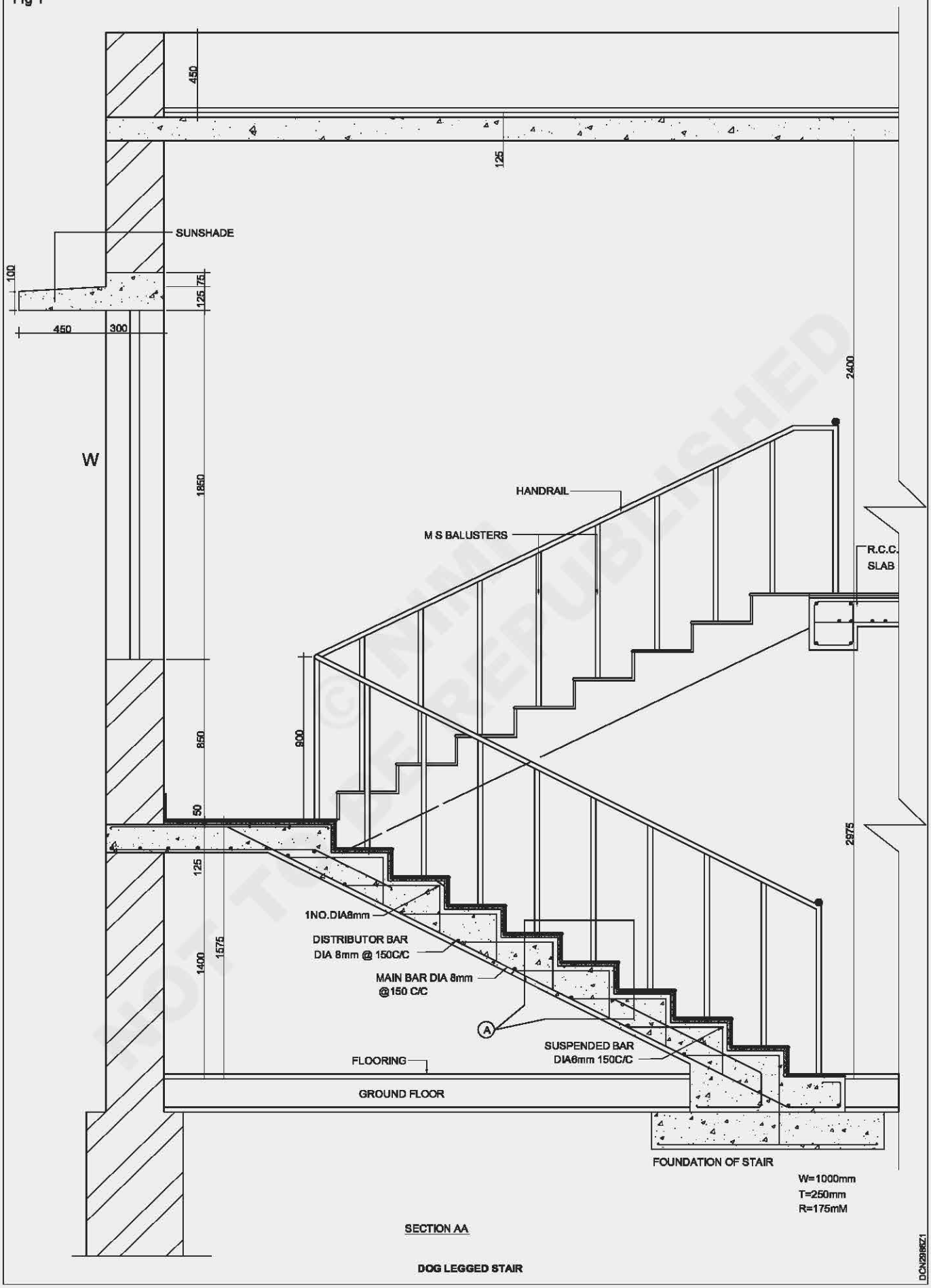
TASK 1 : **Draw the plan and section of halfturn stair RCC dog legged (Fig 1)**

DATA

Room sizes	= 3 x 2m.
Wall	= 30 cm.
Height of floor	= 2.975m.
Tread	= 25cm.
Rise	= 17.5cm.
Width of stair	= 1m.

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Fig 1



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Width of landing = 1m.

R.C.C Slab = 12cm.

R.C.C Beam = 20 x 30 cm.

Hand Rail = 25 mm.

Baluster = 25mm.

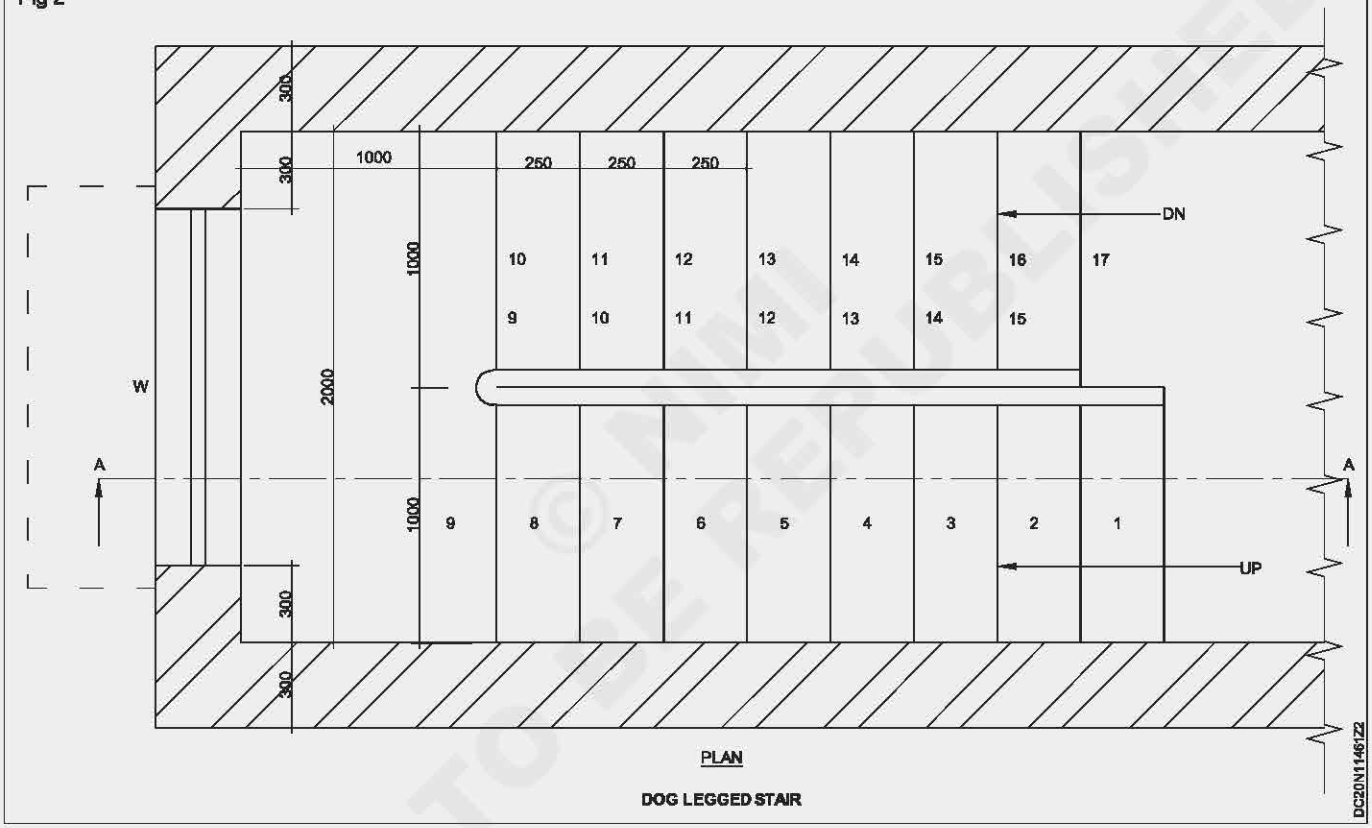
PLAN

- Draw the plan of half turn R.C.C dog legged stair room as per data given with proper number of treads as shown figure 2.
- Draw the landing after nine risers.
- Draw the window in plan.
- Dimension the drawing properly.

Section Elevation

- Draw the Sectional Elevation of the stair by drawing projectors upward from each treads.(fig 1)
- Draw the handrail details as pre given datas.
- Draw the Elevation of the window.
- Dimension the drawing properly.

Fig 2



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Lift or elevators

Objectives : At the end of this exercise you shall be able to
- **prepare the data table of the different loading capacity of lift**
- **draw the schematic diagram of lift well etc for a load of 10 persons**
- **draw the typical arrangements of a lift.**

PROCEDURE

TASK 1: **Draw the plan and section of lift well (Fig 1)**

Load		Car inside		Lift Well		Entry	Entry
Persons	**Kg**	**A**	**B**	**C**	**D**	**E**	**F**
4	272	110	70	190	130	80	160
6	408	110	110	190	160	80	160
8	544	130	110	190	190	80	160
10	680	135	130	190	210	80	160
13	884	200	110	250	190	90	160
16	1088	200	130	250	210	100	160
20	1360	200	155	250	240	100	160

- Draw the size of machine room.
- Draw the lift well 1.90 x 1.53m.
- Draw the wall thickness 30cm.
- Draw the headroom height 2.2m.
- Develop the elevation by projecting each and every point from plan as shown in figure 1.
- Complete the plan and section of lift well.

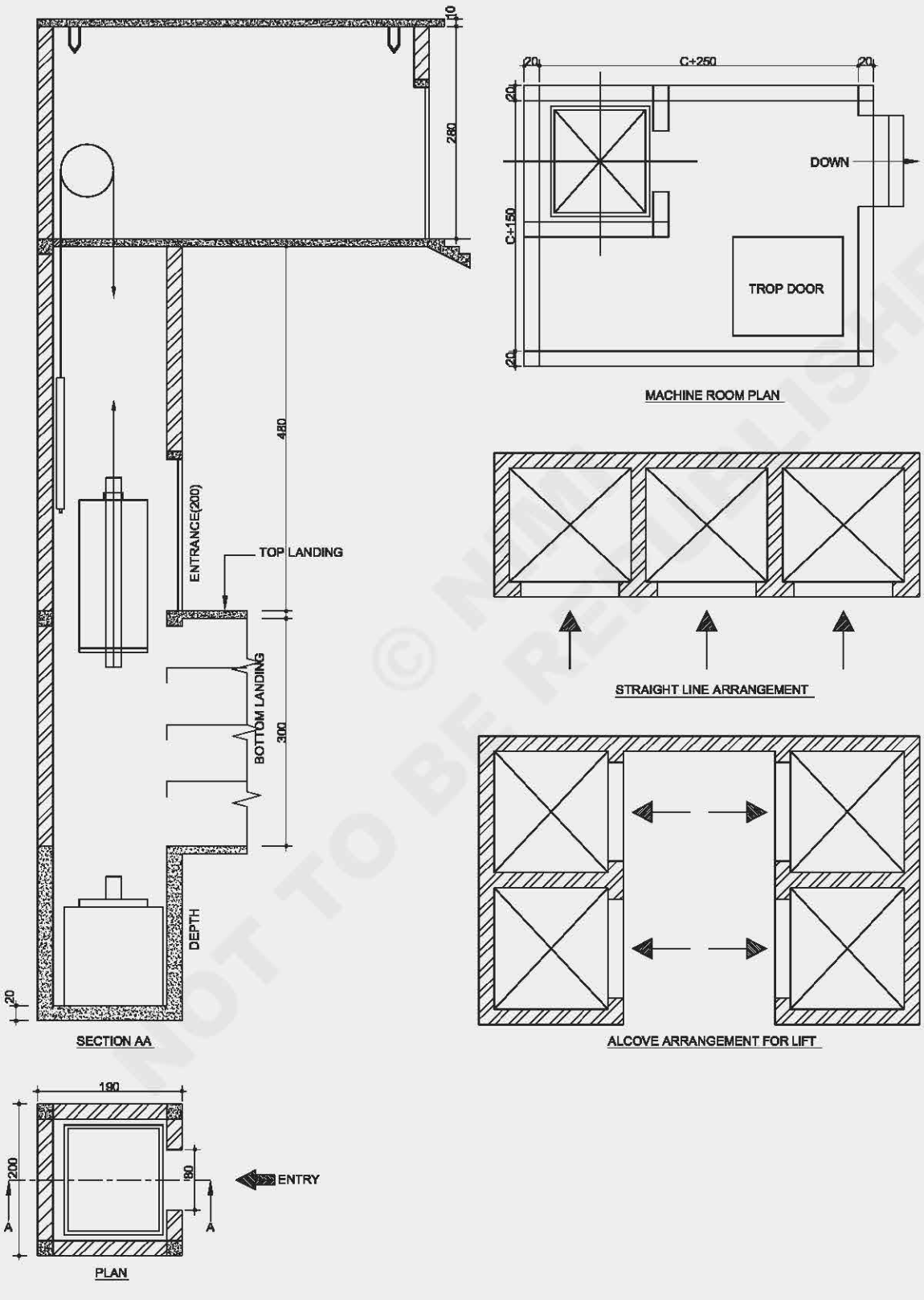
The total head room has been calculated on the basis of car height of 2.2m.

In the case of manually operated doors clear entrance will be reduced by the amount of projection of handle on the landing door.

Four and six passenger's lifts are generally limited to a speed of 1 m/s.

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Fig 1



ESCALATOR AND LIFT WELL

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Moving stairs (escalators)

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

- **draw the plan and section of moving stairs (escalators).**

TASK 1 **: Draw the plan and section of moving stairs (escalators). (Fig 1)**

DATA

Room size = 6 x 2.50 m.

Wall = 30 cm.

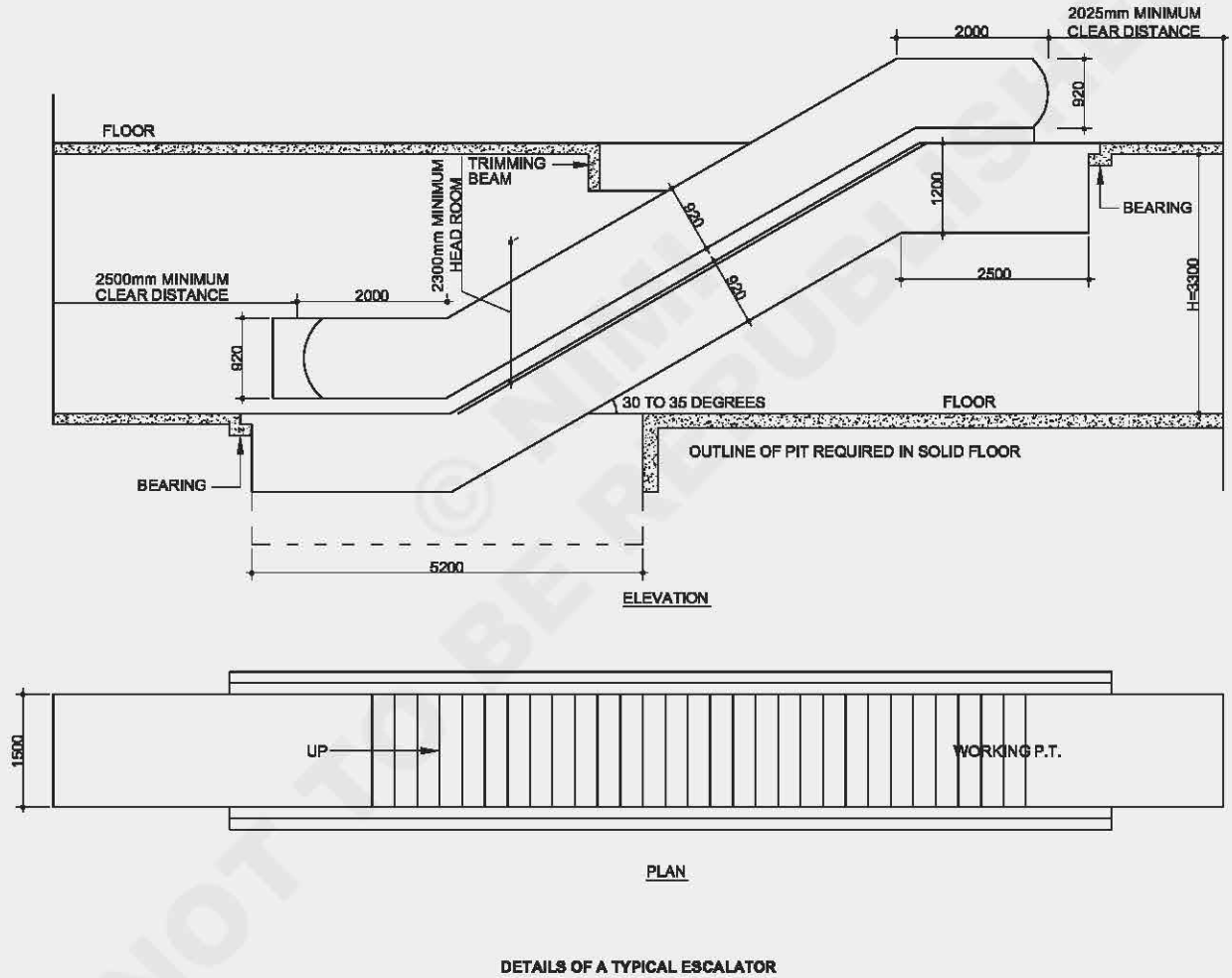
Height of floor = 3.30 m.

Width of landing = 1 m.

Width of stair = 1.50 m.

Complete the drawing showing all details as shown in figure 1.

Fig 1



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Types of sloped roofs

Objectives : At the end of this exercise you shall be able to
- **draw the sectional elevation of lean-to-roof**
- **draw the sectional elevation of couple roof.**

PROCEDURE

TASK 1 : **Draw the sectionof lean-to-roof to a scale 1:50 (Fig 1a)**

DATA

Clear span = 2000mm.

Thickness of main wall = 200mm.

Thickness of verandah wall = 200mm.

Cross section size of wall plate = 150 x 100mm. (varandah wall)

Cross section size of bressumer = 100 x 200mm. (main wall)

Cross section size of rafter = 50 x 125 mm.

Cross section size of battens = 50 x 30 mm at 350 mm C/C.

Cross section size of eaves boards = 25 x 200 mm.

Eaves projection = 600mm.

Pitch of the roof = 30° or 1/3 of span.

Cross section size of corbel stone = 350mm X 200

- Draw main wall and verandah wall 2000mm clear span between them.
- Draw wall plate on the top of verandah wall.
- Draw rafer at angle 30° to the horizontal above the wall plate.
- Draw corbel and bressmer in the main wall, at the position where rafter touches the main wall as show in figure.
- Draw battens above the rafter.
- Draw roof tiles above the battens.
- Draw eave board at end of rafter.
- Complete the drawing as shown in figure 1.

— — — — — — — —

TASK 2: **Draw the sectional elevation of coupleroof (Fig 1b)**

Draw the section of couple roof to a scale 1:50.

DATA

Span = 3000mm.

Thickness of main wall = 200mm.

Cross section size of wall plate = 150 x 100mm.

Cross section size of Ridge piece = 80 x 200mm.

Cross section size of common rafter = 50 x 125mm.

Cross section size of battens = 50 x 30mm at 350 mm C/C.

Cross section size of eave boards = 25 x 200mm.

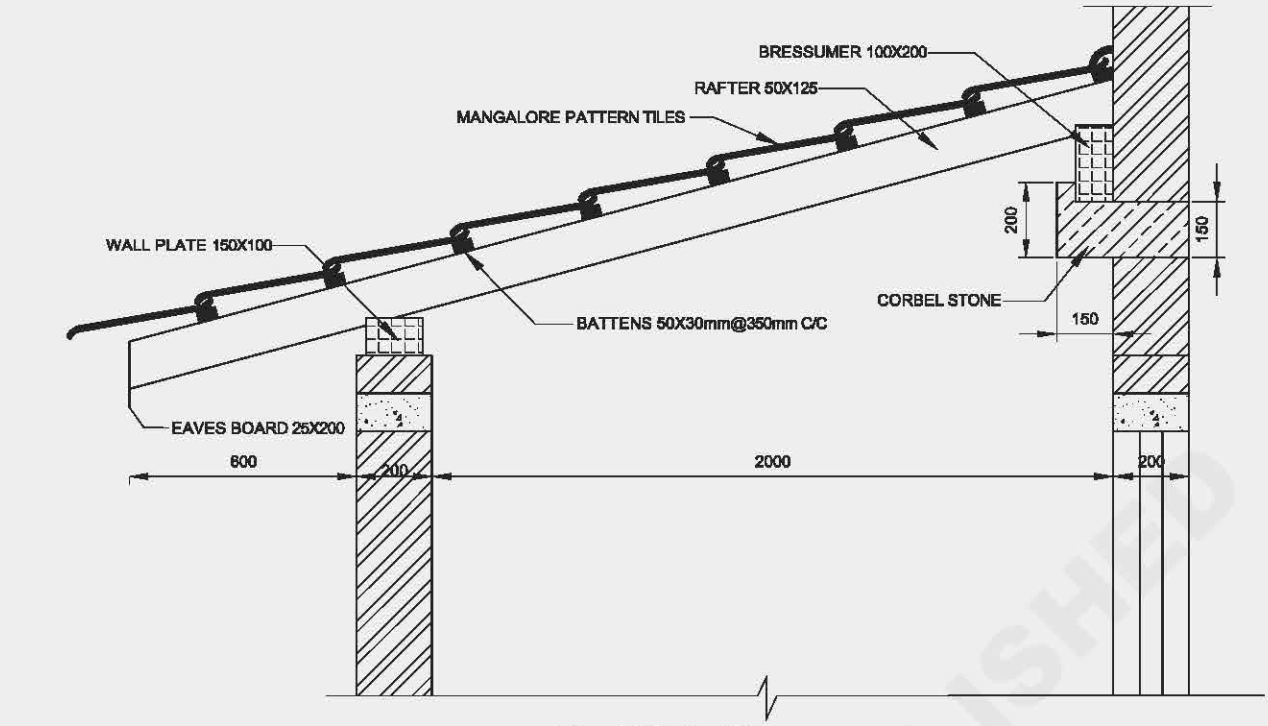
Eave projection = 600mm.

Pitch of the roof = 30° or 1/3 of span.

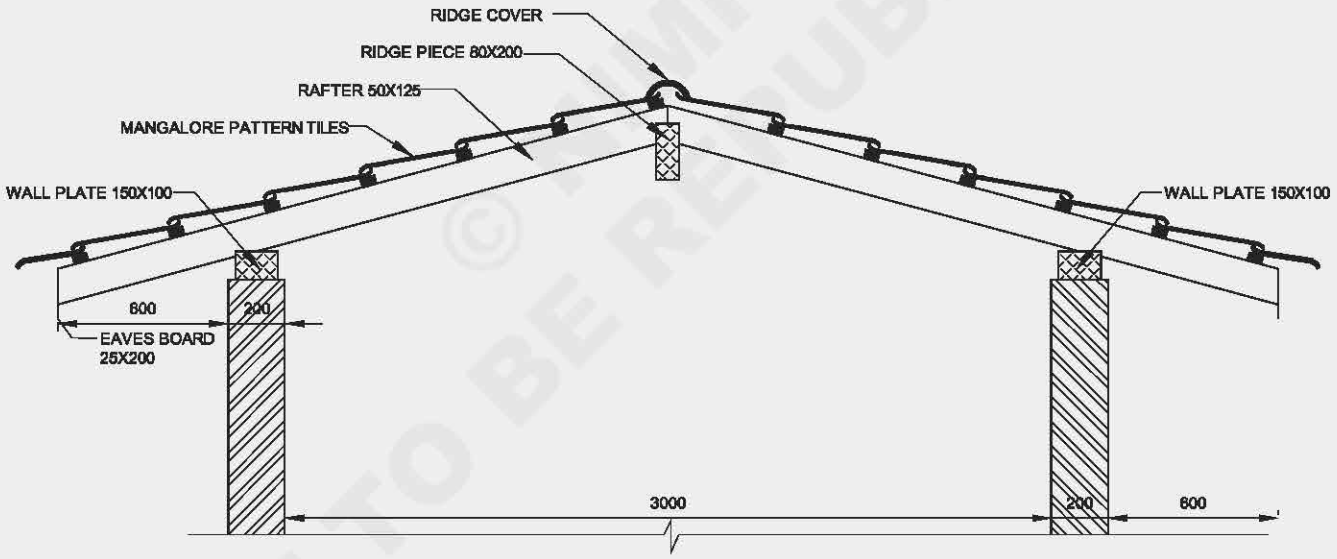
- Draw the main wall with 3000 mm clear span.
- Draw wall plate above the top of main wall.
- Draw common rafter with 30° slope above the top wall plate.
- Draw ridge piece at the junction of common rafter.
- Draw eaves board at the end of common rafter.
- Draw battens above the common rafter.
- Draw roof tiles above the battens.
- Draw ridge cover above ridge piece.
- Completer the drawing as shown in figure 1.

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Fig 1



(a) LEAN TO ROOF



(b) COUPLE ROOF

TYPE OF SLOPE ROOFS

DCN21088H1

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Types of sloped roofs

Objectives : At the end of this exercise, you shall be able to,
- **draw the sectional elevation of couple close roof**
- **draw the sectional elevation of single collar roof**
- **draw the sectional elevation of collar and scissors roof.**

TASK 1 **: Draw the section of couple close roof to scale 1:50 (Fig 1a)**

DATA

Span = 4000mm.

Thickness of main wall = 200mm.

Cross section size of wall plate = 150 x 100 mm.

Cross section size of Ridge piece = 80 x 200mm.

Cross section size of Common rafter = 50 x 125mm.

Cross section size of tie joist = 40 x 150mm.

Cross section size of battens = 50 x 30mm at 350 mm C/C.

Eaves projection = 600mm.

Pitch of the roof = 30° or 1/3 of span.

- Draw the main walls with 4000 mm clear span.
- Draw wall plate above the top of main wall.
- Draw common rafter with 30° slope above the top of wall plate.
- Draw ridge piece at the junction of common rafter.
- Draw tie joist horizontally above the wall plate.
- Draw eaves board at the end of common rafter.
- Draw battens above the common rafter.
- Draw roof tiles above the battens.
- Draw roof ridge cover above ridge piece
- Complete the drawing as shown in figure 1.

— — — — — — — —

TASK 2 **: Draw the sectional elevation of single collar roof (Fig 1b)**

Draw the section of single collar roof to a single 1:50.

DATA

Span = 5000mm.

Thickness of main wall = 200mm.

Cross section size of wall plate = 150 x 100mm.

Cross section size of Ridge piece = 80 x 200mm.

Cross section size of common rafter = 50 x 125mm.

Cross section size of collar = 40 x 125mm.

Cross section size of battens = 50 x 30mm at 350 mm C/C.

Cross section size of eaves boards = 25 x 200mm.

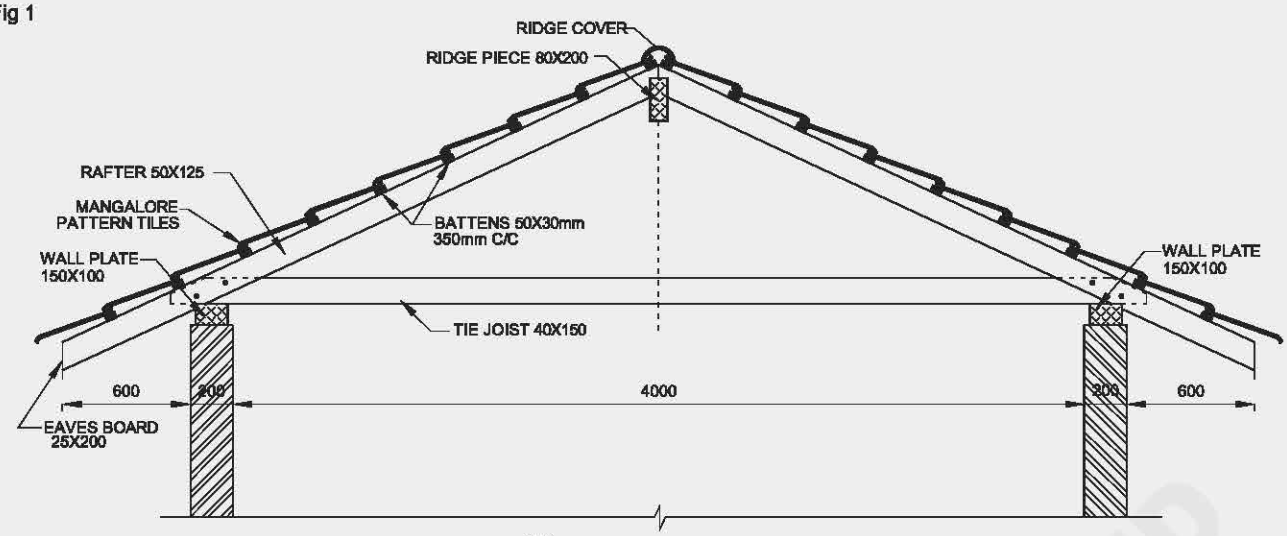
Pitch of the roof = 30° or 1/3 of span.

- Draw the main walls with 5000 mm clear span.
- Draw wall plate above the top of main wall.
- Draw common rafter with 30° slope above the top of wall plate.
- Draw ridge piece at the junction of common rafter.
- Draw collar horizontally from the middle of common rafter.
- Draw eave board at the end of common rafter.
- Draw battens above the common rafter.
- Draw roof tiles above the battens.
- Complete the drawing as shown in figure 1.

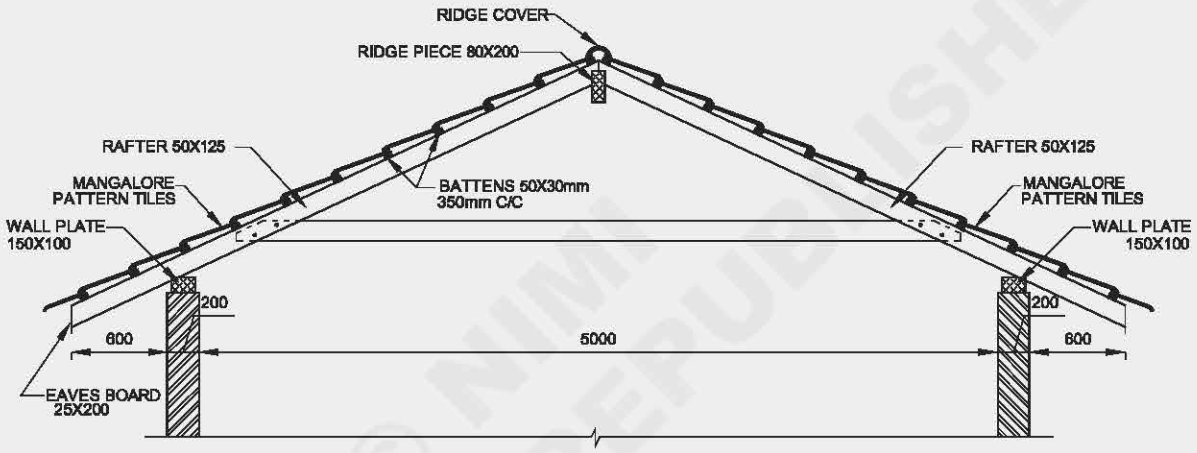
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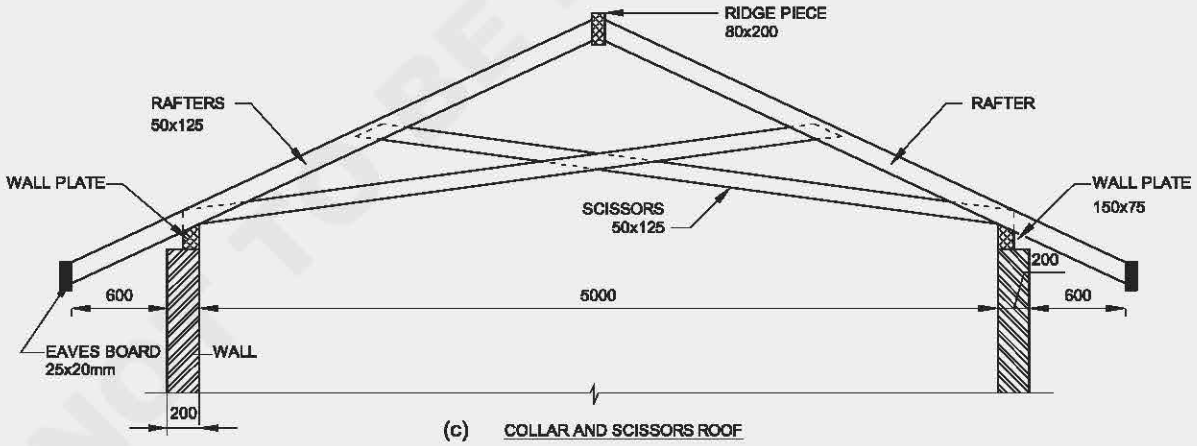
Fig 1



(a) CLOSE COUPLE ROOF



(b) SINGLE COLLAR ROOF



(c) COLLAR AND SCISSORS ROOF

TYPE OF SLOPE ROOFS

DC20N11563J1

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TASK 3: **Draw the section of collar and scissors roof (Fig 1c)**

Draw the section of collar and scissors roof to a scale 1:50.

DATA

Span = 5000 mm.

Thickness of main wall = 300mm.

Cross section size of wall plate = 150 x 75 mm.

Cross section size of ridge piece = 80 x 200mm.

Cross section size of common rafter = 50 x 125mm.

Cross section size of scissors = 50 x 125 mm.

Cross section size of battens = 50 x 30 mm at 350 mm C/C.

Cross section size of eave boards = 25 x 20 mm.

Elevation projection = 600mm.

Pitch of the roof = 30° or 1/3 of span.

- Draw the main walls with 5000 mm clear span.
- Draw wall plate above the top of main wall.
- Draw common rafter with 30° slope above the top of wall plate.
- Draw ridge piece at the junction of common rafter.
- Draw scissors from common rafters as shown in figure 1.

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Draw types of sloped roofs

Objective : At the end of this exercise, you shall be able to,
- **draw the section of double or purlin roof.**

TASK 1 : **Draw the section of double for purlin roof (Fig 1a)**

Draw the section of double or purlin roof to a scale 1:50.

DATA

Span = 5000mm.

Thickness of main wall = 300 mm.

Cross section size of wall plate = 150 x 75 mm.

Cross section size of Ridge piece = 80 x 200mm.

Cross section size of Common rafter = 50 x 125 mm.

Cross section size of tie joist = 50 x 100 mm.

Cross section size of battens = 50 x 30mm at mm C/C.

Cross section size of elevation boards = 50 x 200mm.

Elevation projection = 600 mm.

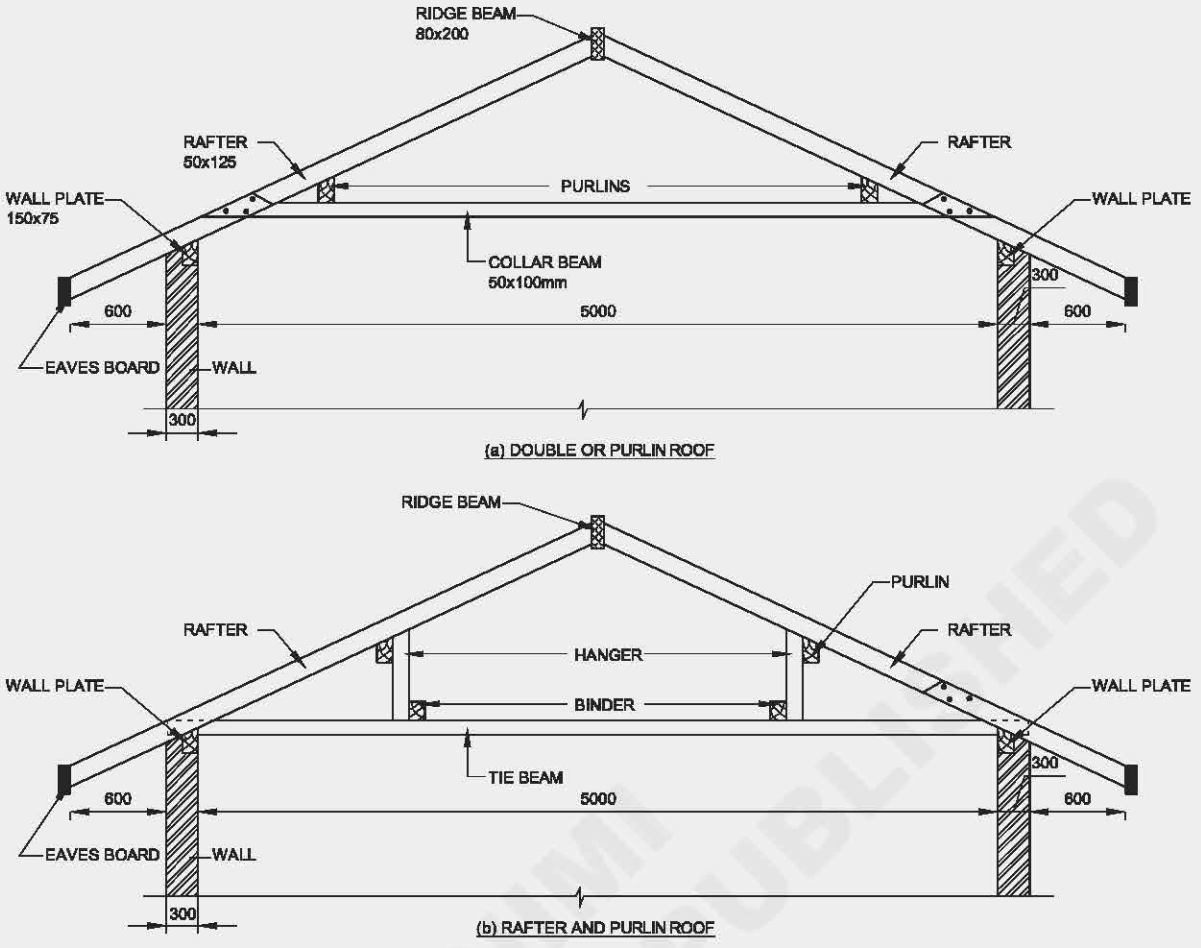
Pitch of the roof = 30° or 1/3 of span.

- Draw the main walls with 5000mm clear span.
- Draw wall plate above the top of main wall.
- Draw common rafter with 30° slope above the top of wall plate.
- Draw ridge piece at the junction of common rafter.
- Draw collar beam and purlins from common rafter as shown in figure.
- Draw eave board at the end of common rafter.
- Draw battens above the common rafter.
- Draw roof tiles above the battens.
- Draw elevation board at the end of common rafter.
- Draw battens above the common rafter.
- Complete the drawing as shown in figure 1.

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Fig 1



TYPE OF SLOPE ROOFS

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Steel roof truss

Objectives: At the end of this exercise you shall be able to
- **draw the elevation of steel truss**
- **draw details of joint of steel.**

PROCEDURE

TASK 1 **: Draw the elevation of steel truss (Fig 1a)**

Draw the section of steel truss to a scale 1:50.

DATA

Span	= 7500mm.
Thickness of main wall	= 300mm.
Tie beam	= ISA 75 x 75 x 6.
Principal rafter	= 2 - ISA 75 x 75 x 6.
Purlin	= ISA 100 x 75 x 6.
Struts	= ISA 65 x 65 x 6.
Gusset plate	= 6 mm thick.
Gusset angle	= 2 - ISA 75 x 75 x 75 x 6.
Base plate	= 300 x 250 x 10.
Anchor bolt	= 20 mm dia.

- Draw the centre line of the steel truss, as per the inclindations in the key diagram.
- Draw the thickness of the members parallel to the centre line.
- Draw the gusset plate and rivets.
- Complete the drawing as shown in figure 1.

— — — — — — — —

TASK 2**: Draw the details of base connection of steel truss (ISOMETRIC VIEW) (Fig 1b)**

Draw the section of steel roof truss a scale 1:10.

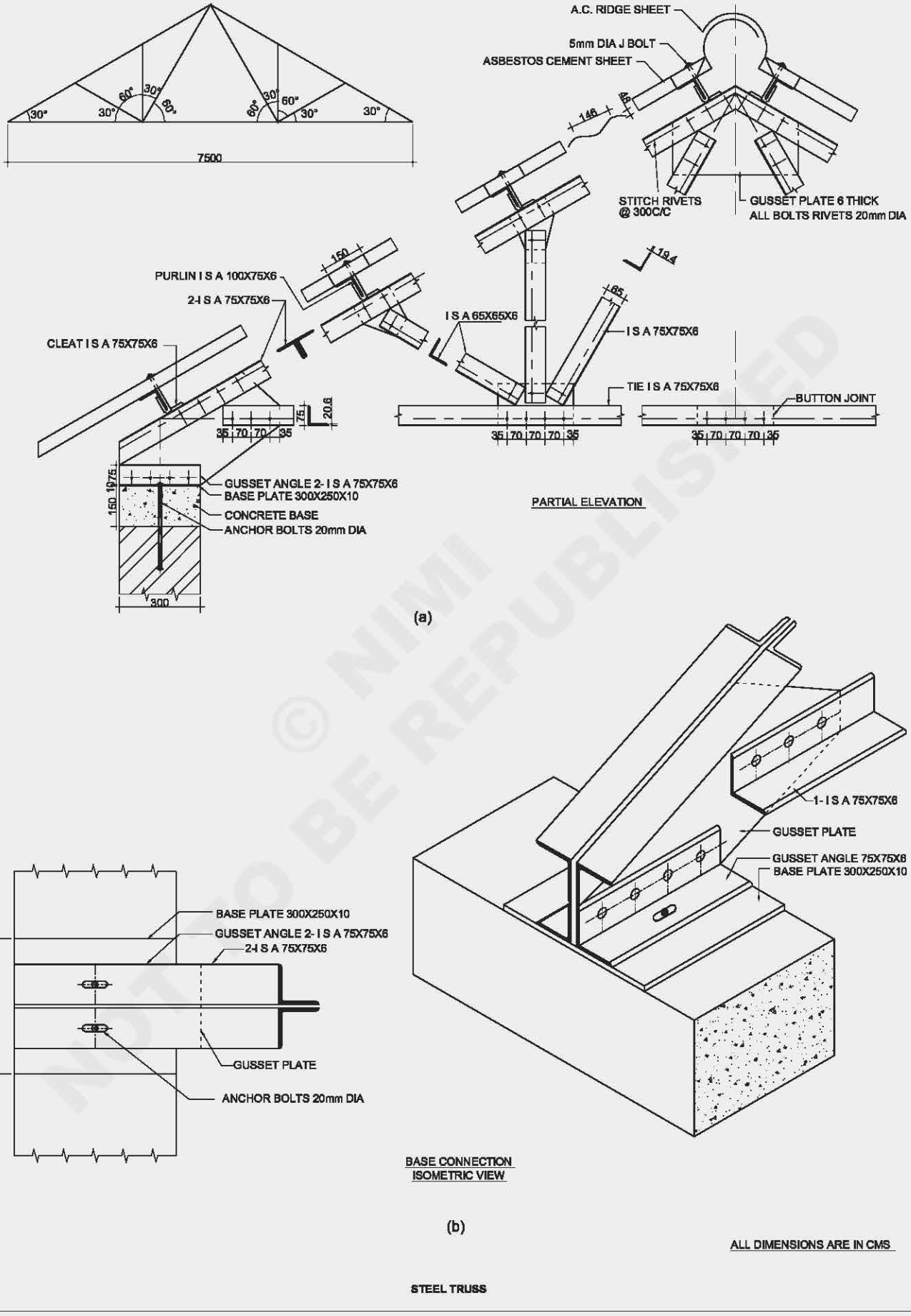
DATA

Thickness of mail wall	= 300 mm.
Tie beam	= ISA 75 x 75 x 6.
Principal rafter	= 2 - ISA 75 x 75 x 6.
Gusset plate	= 6 mm thick.
Gusset angle	= 2 - ISA 75 x 75 x 6.
Base plate	= 300 x 250 x 10.
Anchor bolt	= 20 mm dia.

- Draw the isometric view of wall.
- Draw the base plate above wall.
- Draw gusset angle and gusset plate.
- Draw the principal rafter and tie beam.
- Complete the drawing as shown in figure 1.

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Fig 1



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Tubler steel truss

Objectives: At the end of this exercise, you shall be able to
- **draw the elevation of tubler steel truss**
- **draw details of tubler steel truss.**

TASK 1 **: Draw the elevation of tubular steel truss (Fig 1)**

Draw the elevation of tublar steel truss a scale 1:50.

DATA

Span	= 10000mm.
Thickness of main wall	= 250mm.
Dia of principal rafter	= 50mm.
Tie beam	= 50mm.
Purlin	= 50mm.
Struts	= 25mm.
Centre post	= 40mm.
Base plate	= 250 x 250 x 10.
Bolts	= 12 mm dia.

- Draw the centre line of the tubular steel truss.
- Draw the thickness of the members parallel to the centre line.
- Complete the drawing as shown in figure 1.

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TASK 2 **: Draw the details of base connection of tubular truss at A,B & C (Fig 1)**

Draw the section of tubular steel truss a scale 1:10.

DATA

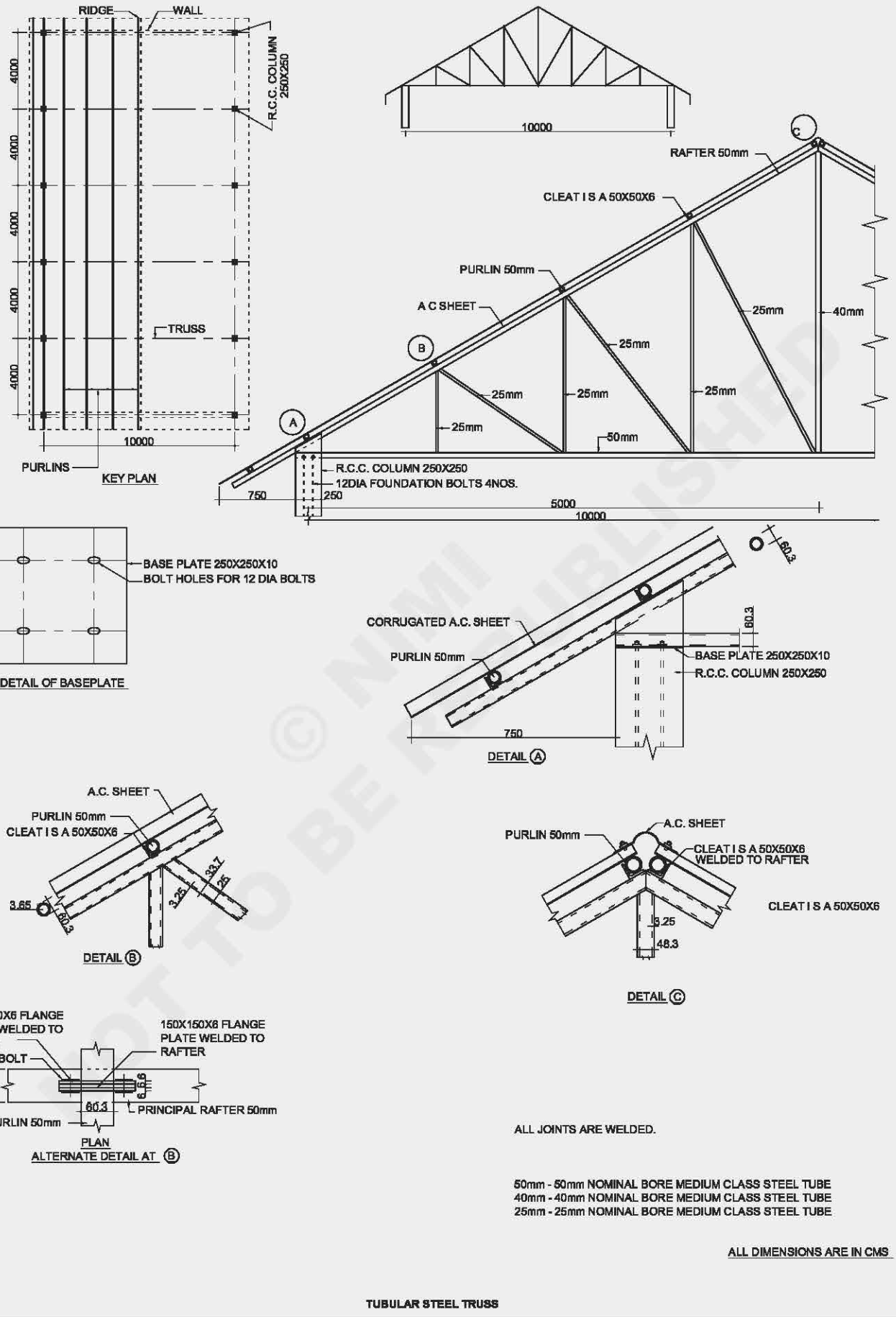
Thickness of main wall	= 250mm.
Dia. of principal rafter	= 50mm.
Tie Beam	= 50mm.
Purlin	= 50mm.
Struts	= 25mm.
Centre post	= 40mm.
Base plate	= 250 x 250 x 10.
Bolts	= 12 mm dia.

- Draw the wall.
- Draw the base plate above wall.
- Draw bolts.
- Draw the principal rafter and tie beam.
- Complete the drawing as shown in figure 1.

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Fig 1



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King post roof truss

Objectives : At the end of this exercise you shall be able to
- **draw the elevation of king post truss**
- **draw details of each joint of king post truss.**

PROCEDURE

TASK 1 **: Draw the elevation of king post roof truss (Fig 1)**

Draw the section of king post truss a scale 1:50.

DATA

Span = 700 cm.

Thickness of main wall = 30cm.

Cross section size of wall plate = 10 x 15cm.

Cross section size king post = 10 x 10cm.

Cross section size of principle rafter = 10 x 15cm.

Cross section size of struts = 15 x 10cm.

Cross section size of Tie Beam = 10 x 20mm.

Cross section size of common rafter = 5 x 10mm.

Cross section size of ridge piece = 5 x 17.5cm.

Cross section size of purlin = 7.5 x 17.5cm.

Size of cleat = 20 x 10 x 2.5cm.

Cross section size of battens = 5 x 3cm @ 35cm C/C.

Cross section size of eaves boards = 5 x 20cm.

Eaves projection = 60cm.

Pitch of the roof = 30° or 1/3 of span.

- Draw two main walls with clear span 7000mm.
- Complete the drawing as shown in figure 1.
- Draw concrete bed block 300 x 100 mm on the top of main wall.
- Draw 7600 x 200 mm rectangle for tie beam.
- Draw centre line of king post truss.
- Draw centre line of struct .(30° inclination)
- Draw wall plate at the end of tie beam as shown in figure 1.
- Draw the centre line of principle rafter.
- Draw parallel line from the centre line to inside and outside according to the size of members. (king post, strut, principle rafter)
- Draw ridge piece above the king post.
- Draw purlin above the principle rafter.
- Draw cleat to support the purlin.
- Draw common rafter above the purlin.
- Draw battens above the comon rafter.
- Draw the roof tiles above the battens.
- Draw eave boards at the end of common rafter.

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TASK 2 **: Draw the details of ridge connection king post truss (Fig 1 - #A)**

Draw the detail (A) of king post truss in a scale 1:10.

DATA

Cross section size of king post =10 x 10 cm.

Cross section size of principle rafter = 10 x 15cm.

Cross section size of common rafter = 5 x 10 cm.

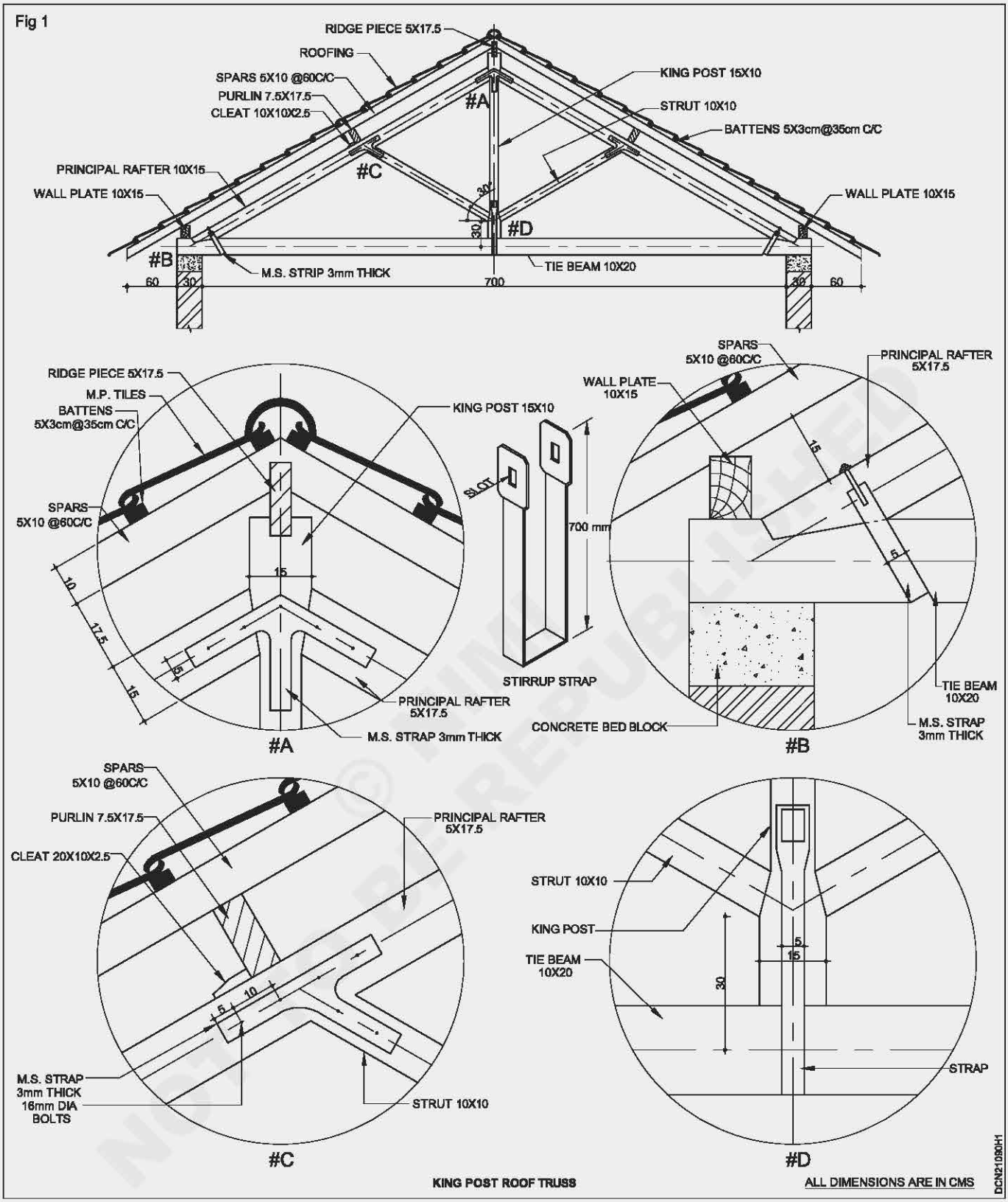
Cross section size of ridge piece = 5 x 17.5 cm.

- Draw the king post and principle rafter.
- Draw ridge piece above the king post.
- Draw common rafter above the priniciple rafter.
- Draw M.S strap at connection of strut and principle rafter.
- Draw battens above the common rafter.
- Draw tiles above the battens.
- Complete the drawing as shown in figure A.

— — — — — — — —

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Fig 1



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TASK 3 : **Draw the details of wall, tie beam, principle rafter of king post roof truss (Fig 1 - #B)**

Draw the detail (B) of king post truss a scale 1:10.

DATA

Thickness of main wall = 30 cm.

Cross section size of wall plate = 10 x 15 cm.

Cross section size of principle rafter = 10 x 15 cm.

Cross section size of common rafter = 5 x 10 cm.

Cross section size of Tie beam = 10 x 20 cm.

- Draw the section of main wall.
- Draw 300 x 100 mm rectangle for concrete bed block.
- Extend the bed block top line to the right.
- Draw 200 mm parallel line above the block. (Tie beam)
- Draw wall plate, principle rafter, M.S strap, common rafter etc and complete the drawing as shown in figure B.

— — — — — — — —

TASK 4: **Draw the details of strut and principle pafter connection of king post truss (Fig 1 - #C)**

Draw the details C of king post truss in a scale 1:10/

DATA

Cross section size of struts = 10 x 10 cm.

Cross section size of principle rafter = 10 x 15 cm.

Cross section size of common rafter = 5 x 10 cm.

Cross section size of purlin = 7.5 x 17.5 cm.

Size of cleat = 20 x 20 x 5 cm.

- Draw 30° inclined parallel lines for principal rafter.
- Draw strut.
- Draw purlin and cleat above the principle rafter.
- Draw common rafter above the purlin.
- Draw M.S strap.
- Complete the drawing as shown in figure C.

— — — — — — — —

TASK 5 : **Draw the details of beam, king post & strut connection of king post truss (Fig 1- #D)**

Draw the detail (D) of king post truss in a scale 1:10.

DATA

Cross section size of king post = 10 x 10 cm.

Cross section size of struts = 10 x 10 cm.

Cross section size of Tie beam = 20 x 10 cm.

Cross section size of ridge piece = 5 x 17.5 cm.

- Draw the tie beam and king post.
- Draw the strut both sides of the king post
- Draw M.S strap at connection of tie beam and king post.
- Complete the drawing as shown in figure D.

— — — — — — — —

Queen post roof truss

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

- **draw the elevation of queen post truss**
- **draw details of each joint of queen post truss.**

TASK 1 : **Draw the elevation of queen post roof truss (Fig 1)**

Draw the section of queen post truss a scale 1:50.

DATA

Span = 1200 cm.

Thickness of main wall = 30 cm.

Cross section size of wall plate = 10 x 15 cm.

Cross section size of queen post = 15 x 17.5 cm.

Cross section size of principle rafter = 15 x 17.5 cm.

Cross section size of top joist = 15 x 17.5 cm.

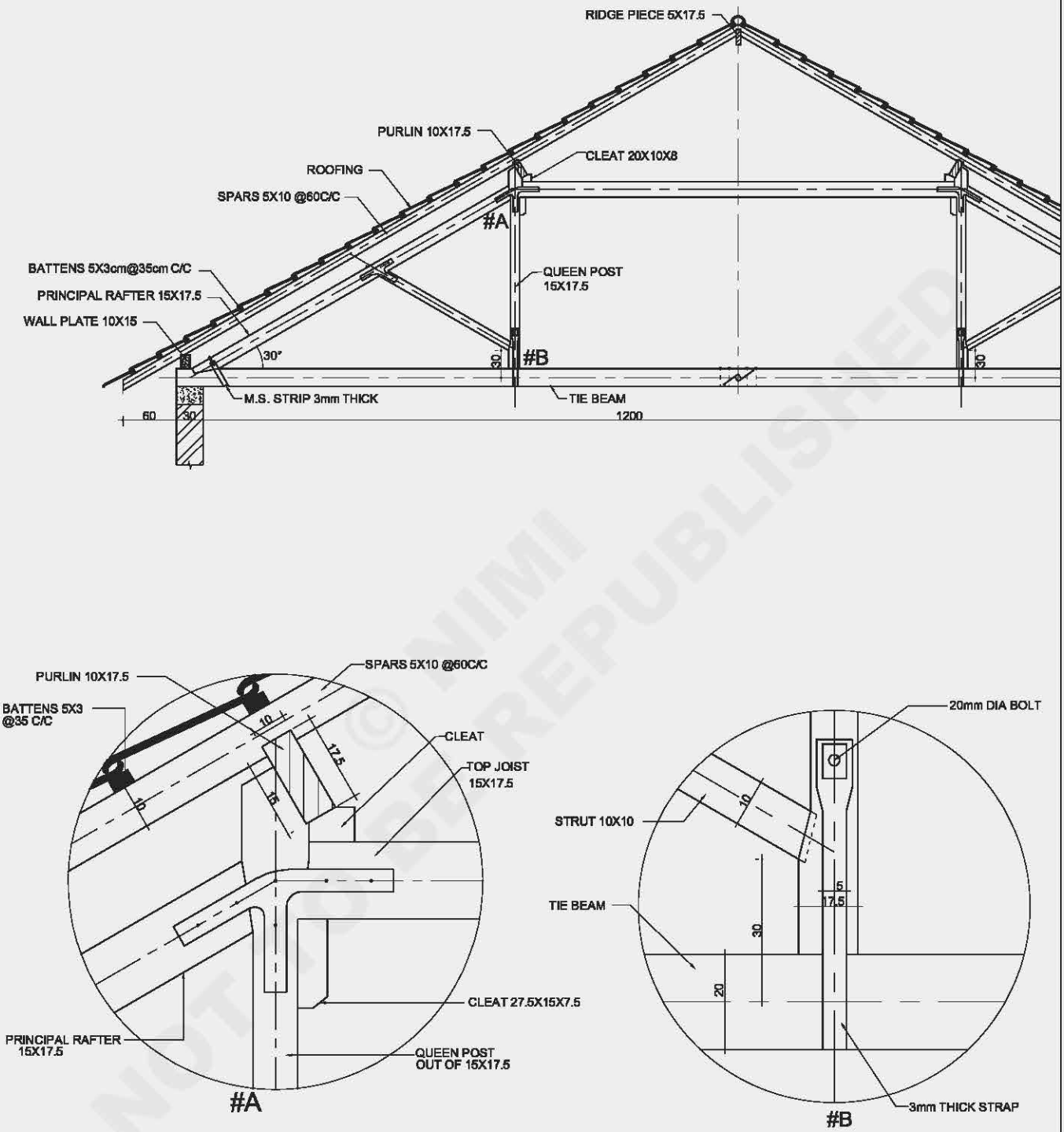
Cross section size of struts = 15 x 10 cm.

Cross section size of Tie beam = 15 x 20 cm.

Cross section size of common rafter = 5 x 10 cm.

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Fig 1



ALL DIMENSIONS ARE IN CMS

QUEEN POST ROOF TRUSS

DCN210801X1

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Cross section size of ridge piece = 5 x 17.5 cm.

Size of cleat = 20 x 10 x 8 cm.

Cross section size of battens = (5 x 3) cm @ 35cm C/C.

Cross section size of elevation boards = 5 x 20 cm.

Elevation projections = 60 cm.

- Pitch of the roof = 30° or 1/3 of span.
- Draw two main walls by with clear span 1200 cm.
- Draw concrete bed block 300 x 100 mm on the top of main wall.
- Draw 1260 x 20 cm rectangle for tie beam.
- Draw centre line of queen post truss.
- Draw wall plate at the end of tie beam a shown in figure 1.
- Draw lines parallel to the centre line to show the thickness of members. (queen post, top joist, strut, principal rafter)
- Draw purlin above the principal rafter.
- Draw Cleat to support the purlin.
- Draw common rafter above the purlin.
- Draw battens above the common rafter.
- Draw the roof tiles above the battens.
- Draw eave boards at the end of common rafter.
- Complete the drawing as shown in figure.

— — — — — — — —

TASK 2 : **Draw the details of top joist queen post & principle rafter connection of queen post truss (Fig 1A)**

Draw the detail (A) of king post truss in a scale 1:10.

DATA

Cross section size of queen post = 15 x 17.5 cm.

Cross section size of top joist = 15 x 17.5 cm.

Cross section size of principal rafter = 15 x 17 .5 cm.

Cross section size of = 10 x 17.5 cm.

Cross section size of = 5 x 10 cm.

- Draw the queen post.
- Draw the top joist on the right side of queen post.
- Draw the principal rafter left side of the queen post.
- Draw M.S strap at connection of tie beam and queen post.
- Draw the cleat and common rafter.
- Draw the roof tiles over the common rafter.
- Complete the drawing as shown in figure A.

— — — — — — — —

TASK 3 : **Draw the details of the beam, queen post & strut connection of queen post Truss (Fig 1B)**

Draw the detail (B) of king post truss in a scale 1:10.

DATA

Cross section size of queen post = 15 x 17.5 cm.

Cross section size of struts = 15 x 10 cm.

Cross section size of Tie beam = 20 x 15 cm.

Cross section size of ridge piece = 5 x 17.5 cm.

- Draw the tie beam and queen post.
- Draw the strut left side of the queen post.
- Draw M.S strap at connection of tie beam.
- Complete the drawing as shown in figure B.

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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 the type of level**
- **identify the parts of dumpy level and auto level**
- **identify the construction of telescopic leveling staff.**

Requirements

Tools/Instruments

• Dumpy level with tripod	- 1 No.	• Telescopic leveling staff	- 1 No.
• Auto level with tripod	- 1 No.	• Nil	

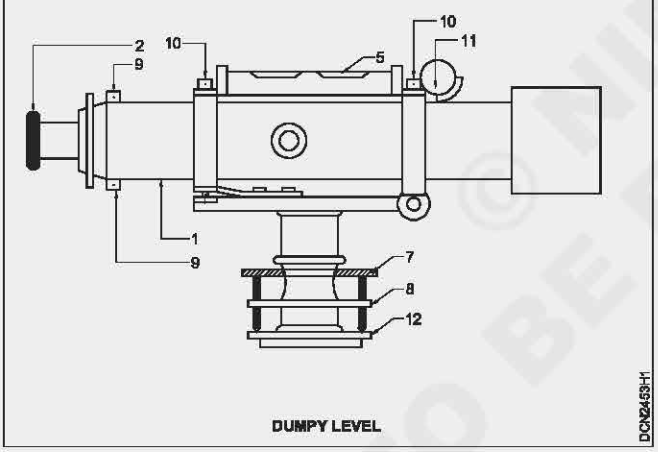
PROCEDURE

1 Remove the dumpy level from the wooden box.Note the position of object glass and eye piece before the removal. (Fig 1)

2 Spread the legs of the tripod at a convenient height.

3 Fix the level over the tripod and explain its parts.

Fig 1

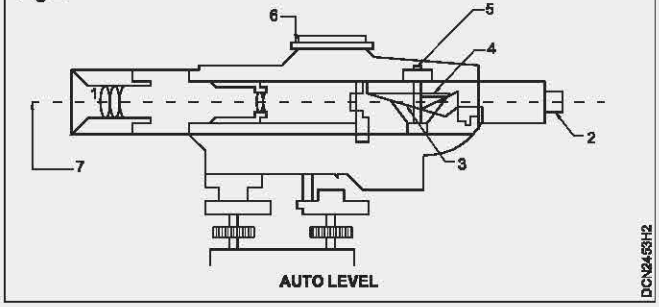


DUMPY LEVEL

1 Telescope, 2. Eye - piece, 3. Ray shade, 4. Objective end, 5, Longitudinal bubble, 6. Focusing screws, 7. Foot scres, 8. Upper parallel plate (Tribrach), 9. Diapharam 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)

Fig 2

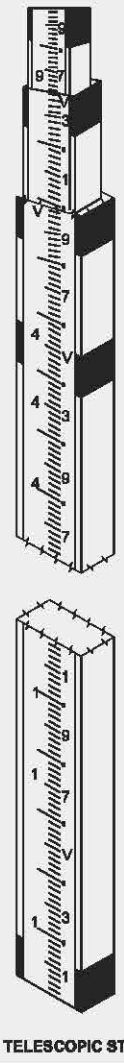


AUTO LEVEL

1. Objective lens, 2. Eyepiece, 3. Compensator object, 4. Compensator suspension, 5. Magnetic dampering system, 6. Line of sight

5 Explain the construction of telescopic leveling staff. (Fig 3)

Fig 3



TELESCOPIC STAFF

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Skill Sequence

Holding of staff

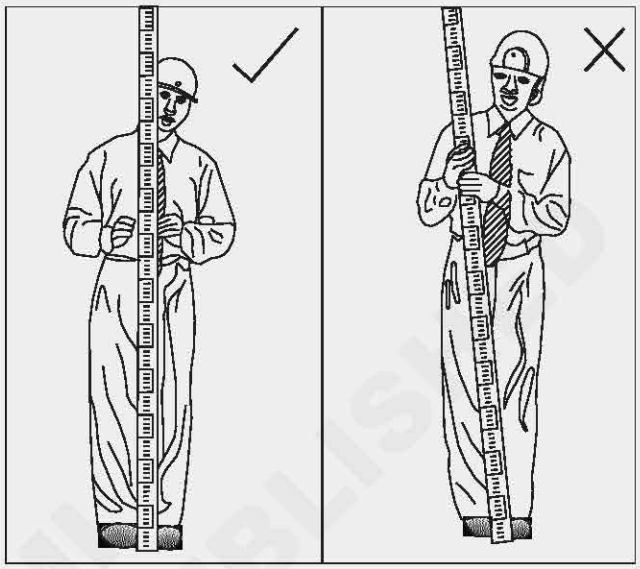
Objective: This shall help you to
- **level the plane table.**

1 Stretch the staff to its full length.

2 Place the bottom for 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

DCN2453J1

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TASK 2: **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 2)	Message
Movement of the left arm over 90°.	Move to my left. (fig 2a)
Movement of the right arm over 90°.	Move to my right. (fig 2b)
Movement of the left arm over 30°.	Move top of staff to my left. (fig 2c)
Movement of the right arm over 30°.	Move top of staff to my right. (fig 2d)
Extension of arm horizontally and moving hand upwards.	Raise height of peg or staff. (fig 2e)
Extension of arm horizontally and moving hand downwards.	Lower height of peg or staff. (fig 2f)
Extension of both arms and slightly thrusting downwards.	Establish the position. (fig 2g)
Extension of arms and placement of hand on top of head.	Return to me. (fig 2h)

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.

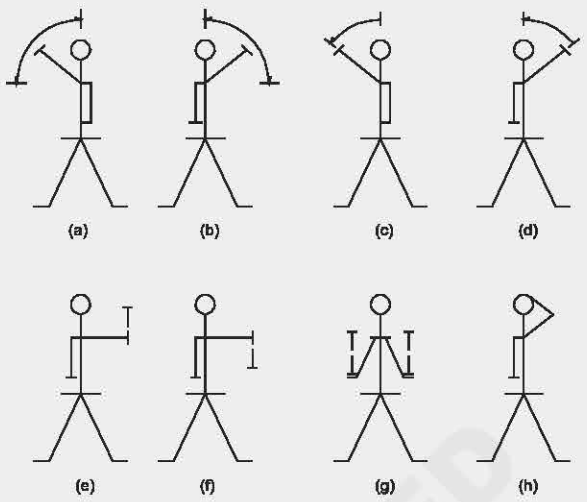
8 Secondly note the black figure denoting the minimum decimeter reading.

9 Finally count the number of black and white strips graduated to read the centimeters and millimeters, where the horizontal cross hair cuts the staff.

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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.

Fig 2



HAND SIGNALS

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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.**

Requirements

Tools/Instruments

- Dumpy level with tripod - 1 No each.
- Telescopic leveling staff - 1 No.
- Level field book - 1 No.

PROCEDURE

TASK 1: **Setting up the tripod on the ground (Fig 1)**

- Loosen the strap of the tripod.
- Spread the legs of the tripod to a convenient height.
- Keep the two legs firmly on one side of a non-slippery ground and the third on the other side.
- Adjust the third leg so that the top of the tripod is approximately horizontal by eye judgement.

Fig 1



LEG ADJUSTMENT

DCN2454-H1

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TASK 2 : **Fix the instrument on the tripod (Fig 1)**

- After noting the position of the level in the box, remove it from the box.
- Release the clamp screw of the instrument and hold it with right hand.
- Turn round the lower part of the level with the left hand and screw the instrument firmly on the tripod.

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TASK 3: **Levelling of the instrument (Fig 2)**

1 Place the telescope parallel to the line joining the two foot screws.

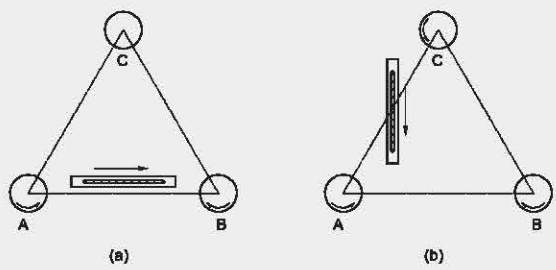
2 Bring the bubble of the spirit level on the telescope to the centre of its run by turning the foot screws beneath the telescope either inward or outward.

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.

Fig 2



LEVELLING UP WITH THREE FOOTSCREWS

DCN2454H2

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TASK 4: **Elimination of parallax (Fig 3)**

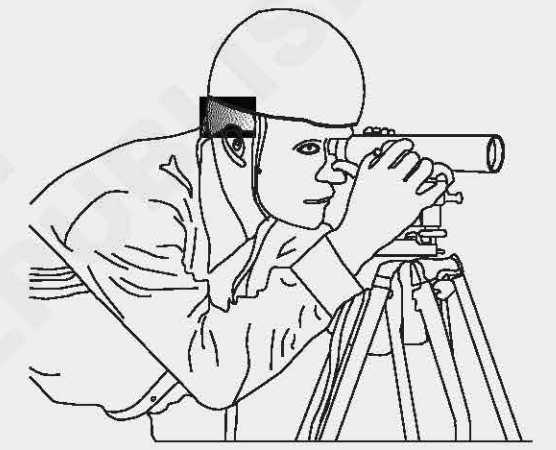
i) Focussing of the eye-piece.

- 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.

ii) Focussing of the object glass.

- Direct the telescope towards the leveling staff.
- Turn the focussing 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 3



FOCUSSING THE OBJECT

DCN2454-I8

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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**
- **determine the RL of a given 5 points from a single instrument position (simple levelling) and observe and enter readings in field book**
- **reduce the levels in two methods.**

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)**

1 Select two station points A and B on a firm ground.

2 Set up and level the instrument approximately at mid point O.

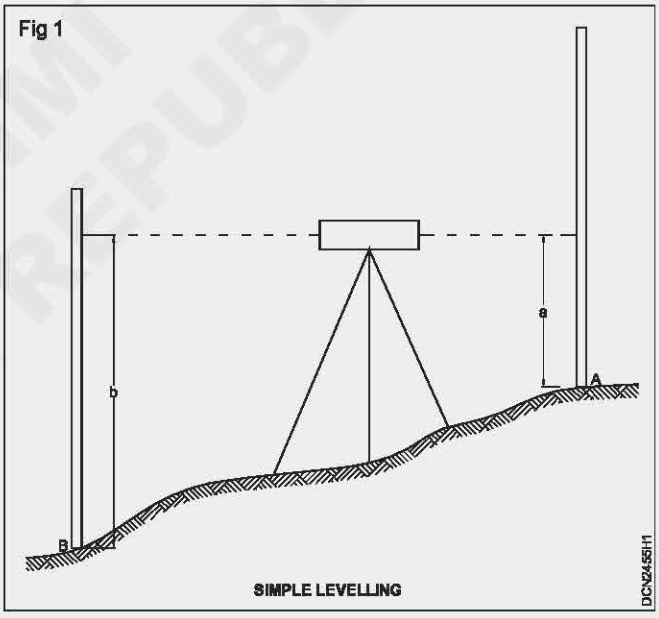
3 Take staff readings on A and B, let the readings be a and b respectively.

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.

Fig 1



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TASK 2: **Determine the RL of a given 5 points from a single instrument position (simple levelling) and observe and enter readings in field book**

1 (Fig 1) Setup and level the instrument position at 'O' which is visible and approximately equal distance to all station.

2 Direct the telescope towards the staff held vertically on BM and focus it carefully to obtain clear graduations.

3 Take the reading (X) and enter Back sight in a field book.

4 Send the staff man to the station A.

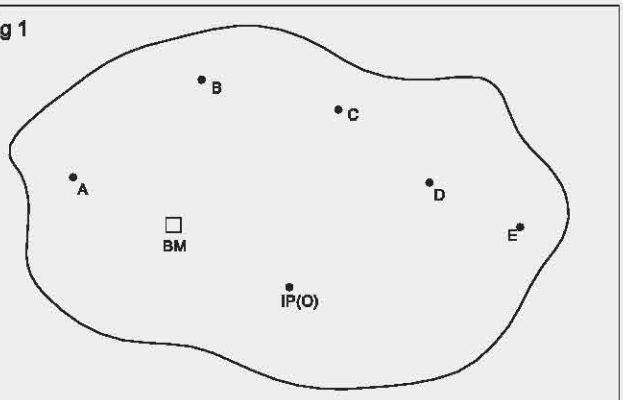
5 Direct the telescope towards the station A, focuss it with again take the inter sight reading (say X1) and enter in a field book.

6 Send the staff man to all stations B,C,D direct the telescope towards the above stations take all the inter sight reading and enter the in a field book (say X2,X3 and X4).

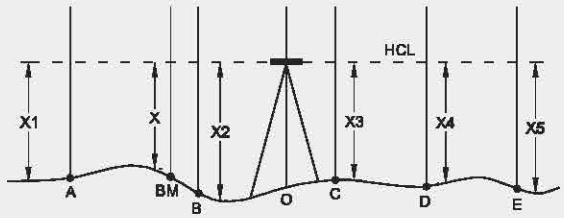
7 Send the staff man to the station E and take the fore sight reading (say X5) and enter in a field book.

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Fig 1



PLAN SHOWING THE INSTRUMENT POSITION AND STATION POINTS



IP - INSTRUMENT POSITION
BM - BENCH MARK
A TO E - STATION POINTS

SIMPLE LEVELLING

DCN24554J1

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TASK 3: **Reduce the levels in two methods**

1 Reduce the levels to all the stations by either

(i) Height of collimation method (or)

(ii) Rise and Fall method.

2 Apply usual arithmetical check.

a) The specimen page of a level book illustrating the method of booking staff readings and calculating RL of stations by Height of collimation method is shown under.

Backsight	Inter sight	Fore sight	HC	Reduced Levels	Remarks
X	X1				Reading taken on BM
	X2				- do - at A
	X3				- do - at B
	X4				- do- at C
		X5			-do- at D
					- do - at E

Height of collimation = R.L of BM + Backsight Reading (X)

Reduced level at A = HCL - Reading at A (X1)

Reduced level at B = HCL - Reading at A (X2)

Reduced level at C = HCL - Reading at A (X3)

Reduced level at D = HCL - Reading at A (X4)

Reduced level at E = HCL - Reading at A (X5)

Arithmatical check :

$\sum$ Back sight - $\sum$ Fore sight = Last RL - First RL.

b) The specimen page of a level book illustrating method of booking staff readings and calculating R.Ls of stations by the rise and fall method is shown under.

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Back sight	Inter sight	Foresight	Rise	Fall	Reduced Levels	Remarks
X	X1					Reading taken on BM
	X2					- do - at A
	X3					- do - at B
	X4					- do- at C
		X5				-do- at D
						- do - at E

If X-X1 is +ve, enter the difference in Rise column. If it is -ve, enter the difference in Fall column.

Similarly X1-X2, X2-X3, X3-X4, X4-X5 is +ve enter the difference in Rise column. If it is -ve, enter the diff. in Fall column.

If the R.L of the BM is known, then R.L of the stations A, B, C, D and E may be obtained by adding its respective rise or subtracting its respective fall from the R.L of proceeding point.

Arithmatical check

$\sum$ B.S - $\sum$ F.S = $\sum$ Rise - $\sum$ Fall = Last RL - First RL.

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Differential 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 / 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

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)

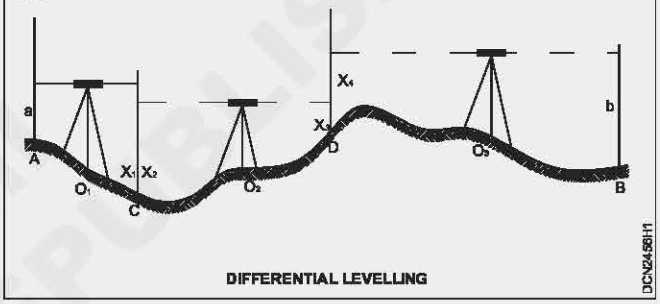
b Take staff readings on stations A and C. Enter the readings on field book as 'a' and 'X_1' respectively.

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.

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

Fig 1



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 / Instruments

- Dumpy level with tripod - 1 No.
- Telescopic leveling staff - 1 No each
- Peg, hammer - 1 No each

Materials

- Level field book - 1 No.
- Pencil - 1 No.
- Eraser - 1 No.

PROCEDURE

TASK 1: **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 coloumn 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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Problems in levelling (Height of collination - Rise and fall method)

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.**

Requirements

Tools / Instruments

- Dumpy level with tripod - 1 No.
- Telescopic leveling staff - 1 No each.
- Peg, hammer - 1 No each.

Materials

- Level field book - 1 No.
- Pencil - 1 No.
- Eraser - 1 No.

TASK 1: Problem in levelling

Following consecutive readings were taken on points 1 to 7 along a line.

0785, 1.326, 2.538, 3.435, 1.367, 2.328, 1.234, 1.657

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.

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TASK 2 :

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.

Station	B.S.	I.S.	F.S.	R.L.	Remarks
1	1.430			200.000	B.M. 1
2		2.015			
3		1.005			
4	3.370		0.400		C.P.
5		2.975			
6		1.415			
7			0.695		B.M. 2

Solution: By Height of collimation method

Station	B.S.	I.S.	F.S.	Height of collimation	R.Ls.	Remarks
1	1.430			201.430	200.00	B.M. 1
2		2.015			199.415	
3		1.005			200.425	
4	3.370		0.400	204.400	201.030	C.P.
5		2.975			201.425	
6		1.415			202.985	
7			0.695		203.705	B.M. 2

General rule in height of collimation method is

Height of collimation = R.L. of B.M. + B.S. on that B.M.

R.L. of any point = Height of collimation - I.S. / F.S. of that point.

∴ Height of Collimation for the 1st set up

= 200.00 + 1.430 = 201.430

R.L. of a point 2 = 201.430 - 2.015 = 199.415

3 = 201.430 - 1.005 = 200.425

R.L. of C.P. (4) = 201.430 - 0.400 = 201.030

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Height of collimation for the 2nd set up

= 201.030 + 3.370 = 204.400

R.L. of a point 5 = 204.400 - 2.975 = 201.425

6 = 204.400 - 1.415 = 202.985

R.L. of B.M.2 (7) = 204.400 - 0.695 = 203.705

Arithmetical check

Σ B.S. = 1.430 + 3.370 = 4.800

Σ F.S. = 0.400 + 0.695 = 1.095

Σ B.S. - F.S. = 4.800 = 1.095 = 3.705

Last R.L. - First R.L. = 203.705 - 200.000 = 3.705

Σ B.S. - Σ F.S. = last R.L. - First R.L.

Hence OK

By rise and fall method

Station	B.S.	I.S.	F.S.	Rise	Fall	R.Ls.	Remarks
1	1.430					200.00	B.M. 1
2		2.015			0.585	199.415	
3		1.005		1.010		200.425	
4	3.370		0.400	0.605		201.030	C.P.
5		2.975		0.395		201.425	
6		1.415		1.560		202.985	
7			0.695	0.720		203.705	B.M. 2

General rule

Difference in level between the successive points

1st reading - 2nd reading = ± Rise / Fall.

R.L. of any point = R.L. of the previous point ± Rise/Fall

Difference in levels for station 2

= 1.30 - 2.015 = - 0.585 (Fall)

For Station 3 = 2.015 - 1.005 = + 1.010 (Rise)

4 = 1.005 - 0.440 = + 0.605 (Rise)

5 = 3.370 - 2.975 = + 0.395 (rise)

6 = 2.975 - 1.415 = + 1.560 (Rise)

7 = 1.415 - 0.695 = + 0.720 (Rise)

R.L. of a station point 2 = 200.00 - 0.585 = 199.415

3 = 199.415 + 1.010 = 200.425

4 = 200.425 + 0.605 = 201.030

5 = 201.030 + 0.395 = 201.425

6 = 201.425 + 1.560 = 202.985

7 = 202.985 + 0.720 = 203.705

Arithmetical check

Σ B.S. = 1.430 + 3.370 = 4.800

Σ F.S. = 0.400 + 0.695 = 1.095

Σ B.S. - Σ F.S. = 4.800 - 1.095 = 3.705

Σ Rise = 1.010 + 0.605 + 0.395 + 1.560 + 0.720 + 4.290

Σ Fall = 0.585

Σ Rise - Σ Fall = 4.290 - 0.585 = 3.705

Last R.L. - First R.L. = 203.705 + 200.00 = 3.705

Σ B.S. - Σ F.S. = Σ Rise - Σ Fall = Last R.L. - First R.L.

Hence OK.

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Calculate missing data 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 arithemetic check**
- **solve various problems.**

Requirements

Tools / Instruments

- Dumpy level with tripod - 1 No.
- Telescopic leveling staff - 1 No each.
- Peg, hammer - 1 No each

Materials

- Level field book - 1 No.
- Pencil - 1 No.
- Eraser - 1 No.

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

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(vi) Tabulate the Result.

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

= 3.377 - 1.476 = 2.296 - 0.395 = 35.401 - 33.500

= 1.901 = 1.901 = 1.901

— — — — — — — —

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**
- **practice of levelling with Wye (y) level instrument**
- **practice of levelling with Cookes revevible instrument**
- **practice of levelling with Tilting level instrument.**

Requirements

Tools / Instruments

• Dumpy level	- 1 No.
• Autolevel	- 1 No.
• Wye level	- 1 No.
• Cooke's level	- 1 No.
• Tilting level	- 1 No.
• Tripod	- 1 No.

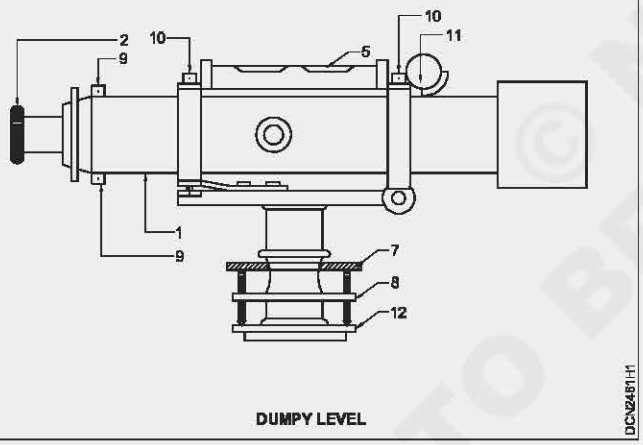
Materials

• Level field book	- 1 No.
• Paper	- 1 No.
• Pencil	- 1 No.
• Eraser	- 1 No.

PROCEDURE

TASK 1: **Practice on Dumpy level (Fig 1)**

Fig 1



DUMPY LEVEL

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.

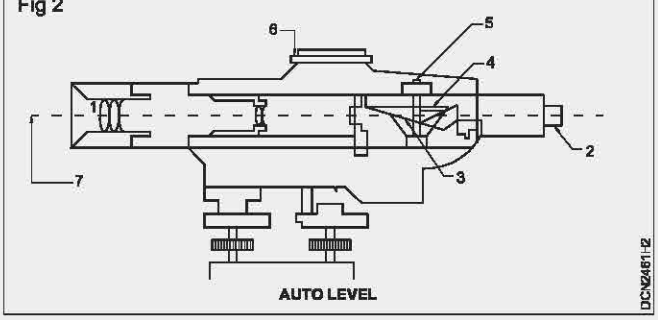
1. Telescope, 2. Eyepiece, 3. Ray shade, 4. Objective end, 5. Longitudinal bubble, 6. Focusing screws, 7. Foot screws, 8. Upper parallel plate (Tribrach), 9. Diaphragm adjusting screws, 10. Bubble tube adjusting screws, 11. Transverse bubble tube, 12. Foot plate. (Trivet stage)

TASK 2: **Practice on Auto level (Fig 2)**

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.

Fig 2



AUTO LEVEL

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TASK 3: **Practice on Wye (y) level (Fig 3)**

The same procedure should be adopted as in dumpy level handling and practice.

The figure shows the parts of wye (y) level.

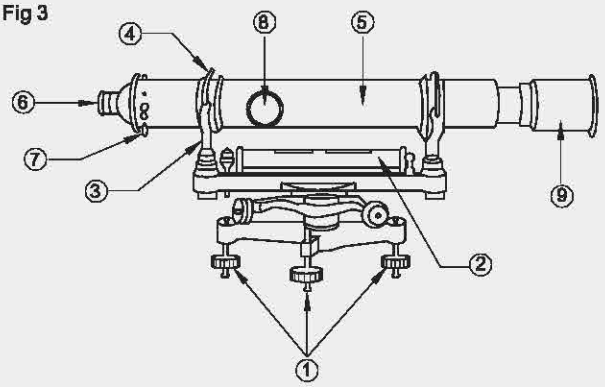
Level can be revolved about its longitudinal axis in the Y"s.

It is very delicate and non-compact in structure.

It has got many loose and open parts - subjected for frictional week.

Wye (Y) Level.

Fig 3



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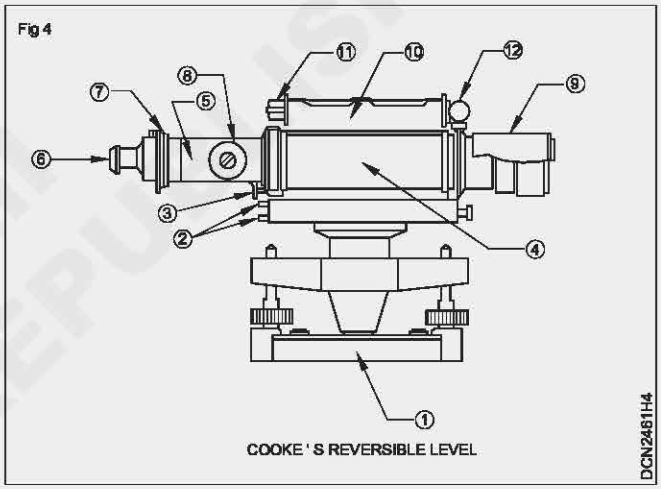
TASK 4: **Practice an Cooke's Reversible level**

Fig 4 Shows the level and parts.

1. Levelling head.
2. Limb nuts.
3. Stop - screw.
4. Socket.
5. Telescope.
6. Eye-Piece.
7. Diaphragm Screws
8. Focusing screw.
9. Ray-shade.
10 level tube.
11. Level tube nuts.
12 Cross-bubble tube.

- It is the combination of dumpy level and wye levels.
- By providing a flange screw it acts for reversibility of the telescope.
- Hence it is named as cookes reversible level.
- By loosening the stop screws the telescope can be rotated about the longitudinal axis.

Fig 4



- Trainees should practice an this level- with guidance of the instructor - following the procedure on done in earlier cases.

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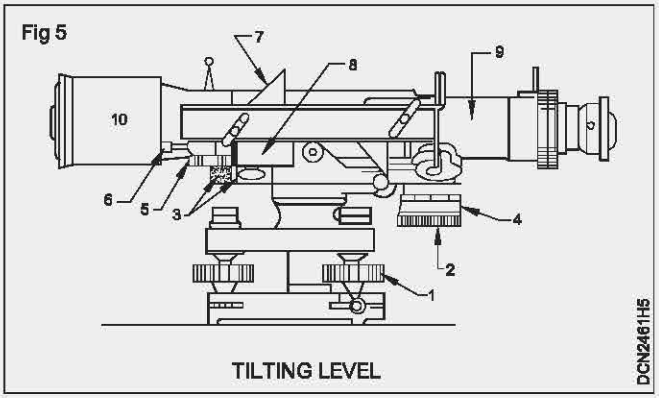
TASK 5: **Practice on tilting level**

Fig 5 shows the instruments and its parts.

1. Levelling screws.
2. Micrometer screw.
3. Cross levels.
4. Scale.
5. Milled head.
6. Clamp screw.
7. Prism.
8. Reflector.
9. Telescope.
10. Ray - shade.

- Telescope of this level has a small motion about horizontal axis just below it.
- In this level the line of collimation x at right angles to the vertical axis of the instrument.

Fig 5



- Trainees should study the parts and its function. Practice leveling as done previously.
- Instructor should guide the trainees for closing practice.

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Fly levelling & check levelling

Objectives : At the end of this exercise you shall be able to
- **explain fly levelling**
- **explain check levelling**
- **explain indirect levelling.**

Requirements

Tools / Instruments

• Dumpy level	- 1 No.
• Tripod	- 1 No.
• Levelling staff	- 1 No.
• Ranging rod	- 1 No.
• Pegs hammer	- 1 No.

Materials

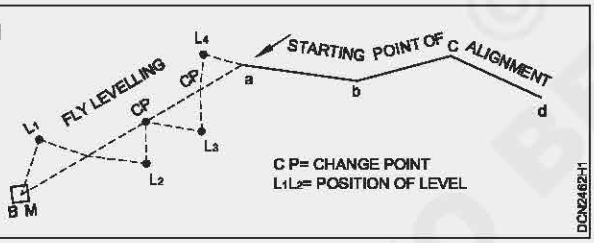
• Level field book	- 1 No.
• Paper	- 1 No.
• Pencil	- 1 No.
• Eraser	- 1 No.

Fly levelling (Fig 1)

When different leveling is done in order to connect a bench mark to the starting point of the alignment of any project, it is called fly levelling is also done to connect the BM to any intermediate point of the aligment for checking the accuracy of the work.

In such leveling, only the back sight and fore-sight readings are taken at every set up of the level and no distances are measured along the direction of levelling. the level should be set up just midway between the BS and the FS.

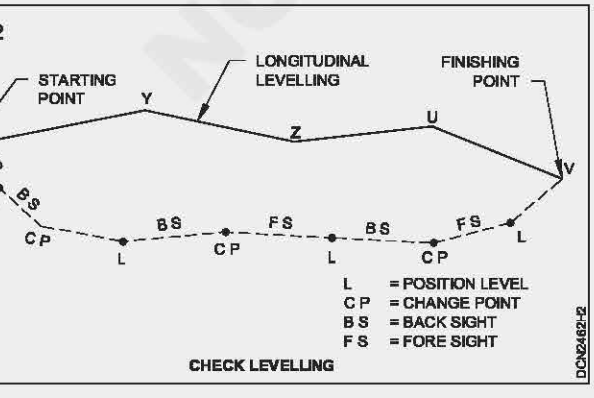
Fig 1



Check levelling (Fig 2)

The fly levelling done at the end of day's work to connect the finished point with the starting point on that particular day is known as check levelling. It is undertaken in order to check the accuracy of the day's work.

Fig 2



Indirect levelling

The method of levelling in which the relative elevations of the points are found out by some indirect observation is known as indirect leveling. It may be carried out in this following three forms:

a Barometric levelling.

b Hypsometry.

c Trigonometrical levelling.

Barometric levelling

The indirect leveling which is conducted to fix the relative elevations of points by the measurement of pressure at these points using barometer is known as barometric levelling.

Barometric levelling is based on the priniciple that the atmospheic pressure varies inversely with the height. This method gives approximate result and so it is adopted in the reconnaissance or in the preliminary survey.

Hypsometry

The method of indirect leveling adopted to find the relatives elevations of points by the measurement boiling points at these points using hypsometer is known as hypsometry. It works based on the principle that boiling points of water decreased at higher altitudes.

Trigonometric levelling

The method of indirect levelling in which the relative elevations of different points are obtained by measuring the vertical angles and horizontal distance is known as trigonometric levelling.

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Problem on reduction of levels

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

- **compute the reduced levels of points and gradiants of lines on sloping ground.**

Problem in differential levelling

Example

Following consecutive readings were taken on points 1 to 7 along a line
0785, 1.326, 2.538, 3.435, 1.367, 2.328, 1.234, 1.657

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 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		97.463	
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

B.S - F.S = 02.152 - 5.092 = - 2.940

Last R.L - First R.L = 97.060 - 100.00 = 2.940 Ans.

Solution for the above problem is rise and fall method

Station	Readings			Rise	Fall	RL	Remarks
	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		97483	
7			1.657		0.423	97.060	
B	2.152	F.S	5.092	1.094	4.034		

Arithmetical Check

B.S- F.S = 2.152 - 5.092 = - 2940

Rise - Fall = 1.094 - 4.034 = 2.940

Last R.L - First R.L = 97.060 - 100.00 = 2.940 Ans.

Exercise 1

Following staff readings were taken with a level. The instrument having been shifted after the fourth, seventh and tenth readings, R.L of the starting Bm is 150.00 m.

Enter the readings in the level book page and reduce the level by the collimate method and apply the usual checks.

1.420, 0.650, 3.740, 3.830, 0.380, 2.270, 4.640, 0.960, 1.640, 2.840, 4.680 and 4.980.

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Longitudinal levelling or profile levelling

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.**

Requirements

Tools/Equipments/Instruments

- Auto level with tripod - 1 No.
- Telescope levelling staff - 1 No.
- Angle measuring instrument - 1 No.
- Pegs, Hammer - 1 No.
- T - Square - 1 No.
- Scale set - 1 No.
- Set Squares - 1 No.

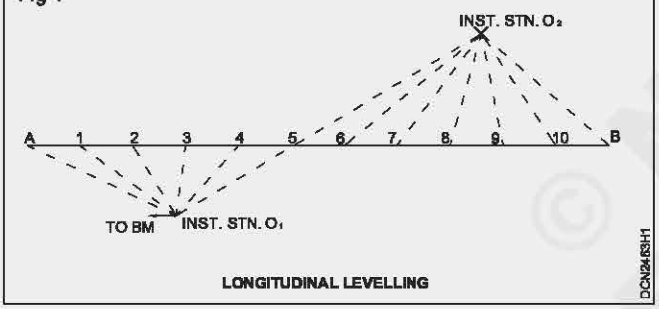
Materials

- Levelling field book, pencil, eraser - 1 No.

PROCEDURE

1 Mark the end points of the centre line AB with ranging rods (Fig 1)

Fig 1



LONGITUDINAL LEVELLING

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 colums 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						

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Plotting of longitudinal section

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

- **prepare the longitudinal section of the route.**

1 Read and interpret the chainages and levels of the route. (Fig 1)

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

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.

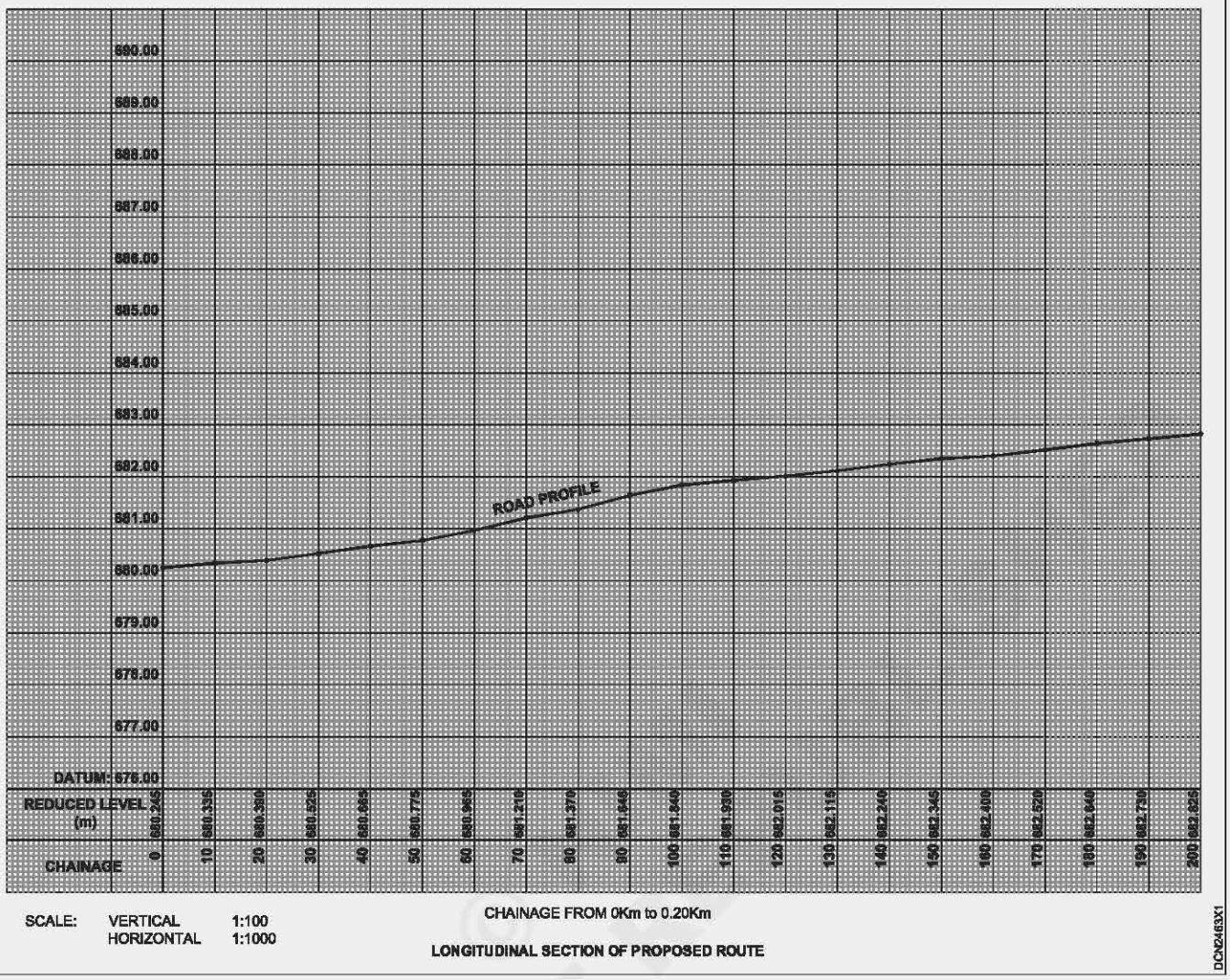
10 Scale off the ground level and mark the ground levels on the respective lines.

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.

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Fig 1



NOT TO BE

Chain survey around a small building by triangulation, and traversing

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.**

Requirements

Tools/Equipments/Instruments

• 30m chain	- 1 No.
• Arrows 40cm long	- 10 No.
• Ranging rod 2/3m long	- 4 Nos
• 30m steel tape	- 1 No.
• Cross staff	- 1 No.
• Peg 15cm long	- 5 Nos.

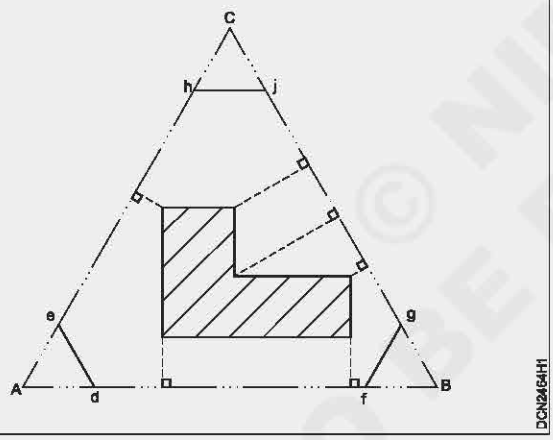
Materials

• Drawing sheet A3	- 1 No.
• Field note book	- 1 No.
• Pencil HB	- 1 No.
• Eraser	- 1 No.
• Set of scale	- 1 No.
• Cello tape	- as reqd.

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.

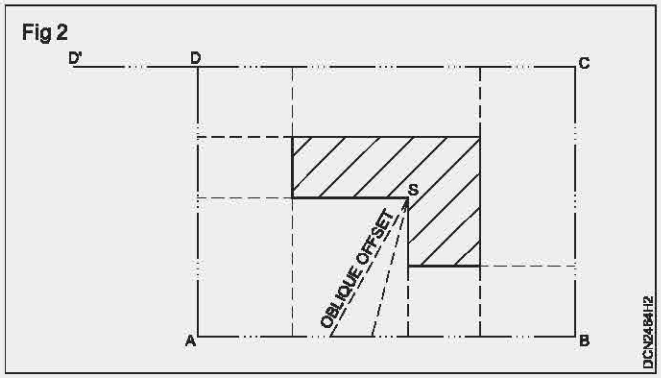
18 Check the measured distance with field measurements for accurancy of the frame work.

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 2)



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.

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 Simillarly, 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'.

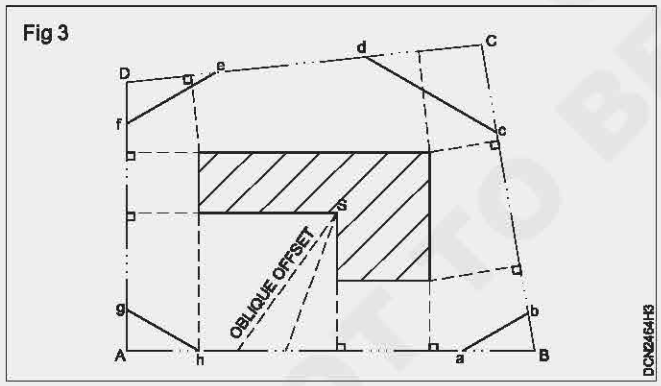
18 Similarly locate the station D and check it from station A.

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 3)



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.

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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.

— — — — — — — —

Skill Sequence

Preparing reference sketch to stations

Objective: This shall help you to
- **prepare reference sketch to the stations.**

1 Mark the station on the field book as shown in Fig 1.

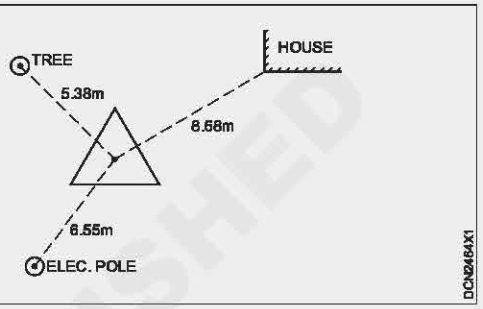
2 Observe the permanent objects which are located around the station.

3 Mark the permenant objects in the field book by drawing rough sketch.

4 Measure the distances.

5 Note the distances in the field book.

Fig 1



— — — — — — — —

Plotting a chain survey

Objective: This shall help you to
- **plot a chain survey.**

Choose a suitable scale according to the importance of the work.

1 Allocate a margin of 2cm around the paper.

2 Select a suitable position of the baseline.

3 Draw the base line by pencil.

> **The accuracy of entire framework is mainly depends upon the accuracy of base line.**

4 Mark the intermediate stations on the base line.

5 Similarly complete the frame work.

6 Check the accuracy of the plotted frame work by means of check and tie lines.

7 Mark the chainage of the points along the chain line from where offsets were measured.

8 Draw the perpendicular lines with set square and scale of length of the offsets.

9 Keep the field book side by side in the same direction when plotting.

10 Ink the lines and objects after completing and checking.

11 Write the title of the survey in right hand corner at the bottom of the drawing.

12 Write the scale of the plan below the title.

13 Mark the north direction at the Right hand corner above the drawing.

— — — — — — — —

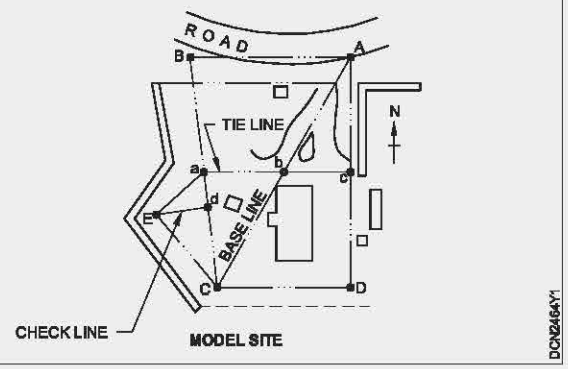
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Chain survey around a group of buildings by triangulation and plotting the same

Objectives: At the end of this exercise you shall be able to
- **prepare key plan of the site**
- **select and fix stations, base lines, check lines, tie lines**
- **take reference sketches for stations**
- **run the chain line and locate the details.**

TASK 1: **Prepare key plan of the site (Fig 1)**

Fig 1



Field work

1 Make reconnaissance survey, prepare a rough sketches of the given site in the field book.

— — — — — — — —

TASK 2: **Select and fix stations, base lines, check lines and tie lines (Fig 2)**

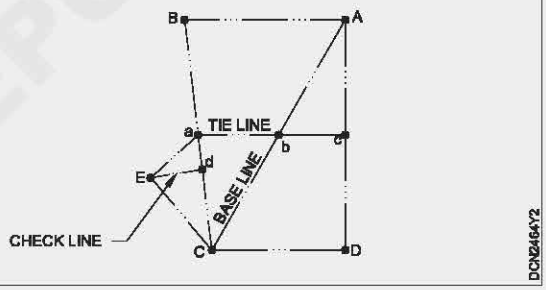
1 Select and mark the main line control stations ABCD and E on the site, to cover the whole area to be surveyed.

2 Select the base line AC.

3 Select and mark the check line Ea, Ed.

4 Select and mark the tie lines ab and bc.

Fig 2



— — — — — — — — —

TASK 3: **Take reference sketches for stations**

1 Take reference sketches for the main stations A,B,C,D and E.

Fig 2 Shows about the selection of main stations, base line, tie line and check line.

— — — — — — — — —

TASK 4: **Run the chain line and locate the details**

1 Run the chain and measure the baseline AC and main lines AB, BC, CD, DA and CE enter in the field book.

2 Measure check line Ea and Ed and enter in the field book.

3 Measure Tie lines ab and bc and enter in the field book.

4 From the above measurements draw the frame work joining all the control points to a suitable scale on the drawing sheet.

5 To check the accuracy of the frame work, measure check lines Ed and Ea tie lines ab and bc in the plotting and verify with the field measurements.

Limit of permissible error.

6 The maximum permissible error is 1 in 1000 (for example + 1m for every 1000m).

If the error is within the maximum permissible value then adjust the lengths of the sides of the wrong triangles after that continue to locate the interior offset details.

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If the error exceeds the permissible value then resurvey the wrong lines to continue the survey.

If there is no error, continuing the survey work, measuring the chainages offsets on both sides of the chain lines and enter in the field book.

7 Plot the details as per field book entries.

8 Print the title of the survey in right hand corner at the bottom or at the top of the drawing thus note the scale of the drawing below it.

9 Mark the north direction in right top corner of the drawing sheet.

10 Determination of area of a plot from plan using planimeter and from field notes.

— — — — — — — —

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Indirect contouring by square method

Objectives: At the end of this exercise you shall be able to
- **determine the reduced levels of points**
- **draw the contour lines.**

Requirements

Tools/Equipments/Instruments

- Dumpy level with tripod - 1 No each.
- Ranging rods, leveling staff tape, pegs, hammer - as reqd.
- Scale set, T-square, set squares - 1 No each.
- Plane table with tripod trought compass, alidade - 1 No each.
- Hammer, scale set - 1 No each.
- Ranging rods, telescopic levelingstaff - as reqd.
- Prismatic compass with tripod - 1 No each.

Materials

- Drawing sheet, field book, pencil, eraser - 1 No.
- Drawing sheet A2 size - 1 No each.
- Level field book - 1 No.
- Pencil eraser - 1 No.

PROCEDURE

1 Divide the whole area into a number of squares of side 10m. (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.

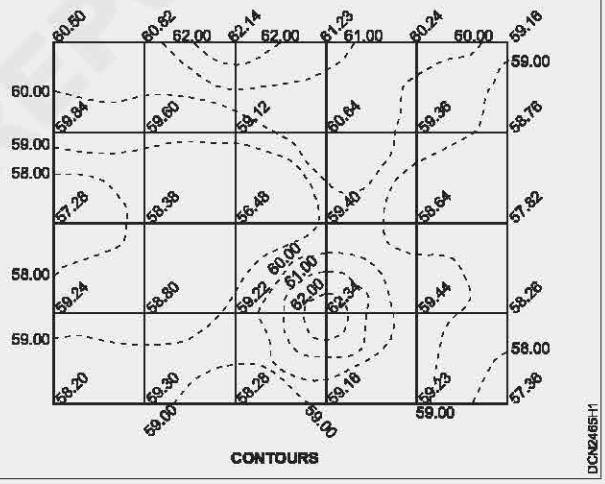
8 Select a suitable scale.

9 Plot the squres 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.

Fig 1



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.

— — — — — — — —

Indirect contouring by plane table and level

Objectives: At the end of this exercise you shall be able to
- **establish various directions using plane table**
- **determine the reduced level using dumpy level**
- **locate the contour points by interpolation**
- **draw the contour lines**.

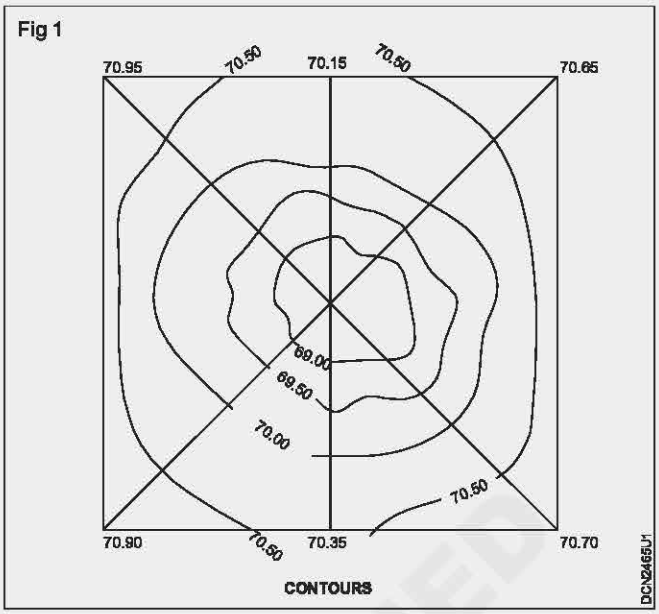
1 Follow the steps 1 to 10.

2 Decide the reduced levels of contour points on the radial lines and locate them by interpolation.

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3 Join the points of same elevation with free hand line to get the contour lines. (Fig 1)

Fig 1



— — — — — — — —

Indirect contouring by cross section

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

- **determine the reduced levels of points**
- **interpolate the contour points**
- **draw the contour lines.**

1 Mark the centre line of the road with ranging rod. (Fig 1)

2 Divide the centre line into different segment according to direction.

3 Measure the direction of these segments using compass.

4 Measuring the length of the line using tape and also mark pegs at an interval of 20m along the centre line.

5 Erect cross section lines at the longitudinal section points.

6 Mark points at an interval of 5m along these cross section lines.

7 Establish a bench mark near the starting point.

8 Set up and level the dumpy level at a convenient position.

9 Take a BS readings on the bench mark. Also take staff readings at various cross section points.

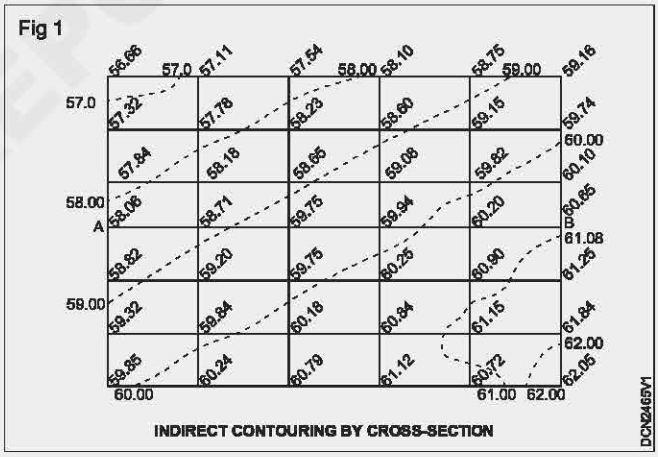
10 Record the staff readings and distance in the respective columns as soon as they are taken.

11 Take FS reading on change point when visibility is being obstructed due to long sight.

12 Continue the work up to the last point and end the work on a bench mark.

13 Compute the reduced levels of the points by height of collimation method.

Fig 1



14 Select a suitable scale.

15 Plot the section and write the corresponding reduced levels of longitudinal as well as cross section points.

16 Read and interpret the reduced levels and decided the contour lines that are to be plotted on the plan from the spot levels.

17 Locate the contour points by arithmetic method of interpolation.

18 Join the points of same elevations by wavy lines to get the contour lines.

— — — — — — — —

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Indirect contouring by radial line using plane table

Objectives: At the end of this exercise you shall be able to
- **determine the reduced level using telescope alidade**
- **interpolate the contour points**
- **draw the contour lines.**

1 Select a suitable point '0' at the centre of the area.

2 Centre and level the plane table over the point '0'.

3 Draw the direction of north on the drawing using trough compass.

4 With telescope alidade pivoting the point '0' draw a line and with line of sight horizontal, take staff readings at the end point of this line i.e top hair reading, central hair reading and bottom hair reading.

5 Similarly draw a number of radial lines and take respective staff readings.

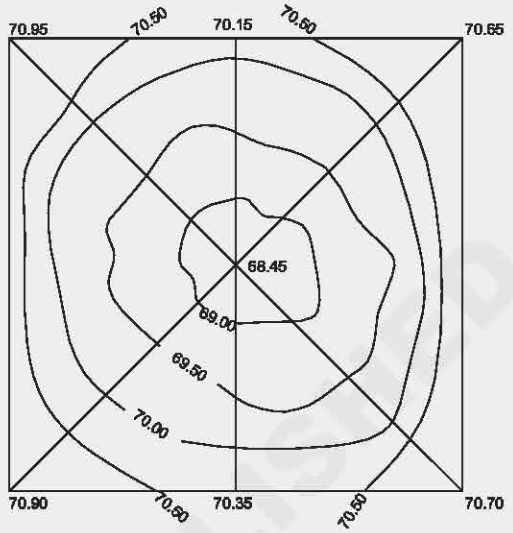
6 Take a BS readings on the bench mark.

7 Also take staff reading on the point '0'.

8 Calculate the distance using the formula D=100S, where D is the horizontal distance between the centre point '0' and the staff station and S is the difference of the top and bottom hair staff reading.

9 Calculate the HI and find the reduced levels of centre point and end points of the radial lines. Reduced level of point = HI center hair reading.

Fig 1



10 Decide the reduced levels of contour points on the radial lines and locate them by interpolation.

11 Join the points of same elevation with free hand line to set the contour lines. (Fig 1)

— — — — — — — —

Direct contouring by radial line using compass

Objectives: At the end of this exercise you shall be able to
- **establish various direction using compass**
- **locate the contour points**
- **draw the contour lines.**

1 Select a point at the centre of the area. (Fig 1)

2 Set up the compass over this point 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 and level the dumpy level near the centre point.

6 Establish a temporary bench mark near the centre point.

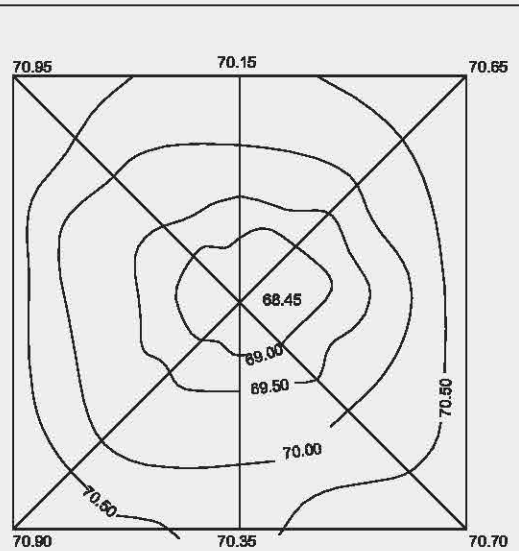
7 Take a BS readings on the beach mark.

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.

Fig 1



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11 Calculate the staff reading required to locate a particular contour point i.e staff reading = Height of instrument - reduced 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 reading 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 line.

15 Repeat this 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.

— — — — — — — —

Indirect contouring by compass and level

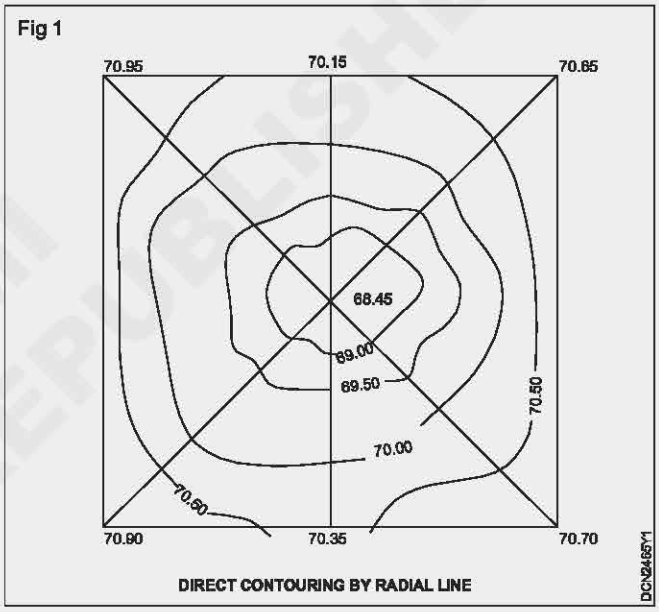
Objectives: At the end of this exercise you shall be able to
- **establish the directions using compass**
- **draw the contour lines.**

1 Follow the steps 1 to 10.

2 Locate the contour points on the radial line by interpolation.

3 Join the points of same reduced levels to get the contour lines. (Fig 1)

Fig 1



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Map reading of Contours and topography map

Objective: At the end of this exercises you shall be able to
- **reading a map.**

Requirements

Tools/Equipments/Instruments
- Nil

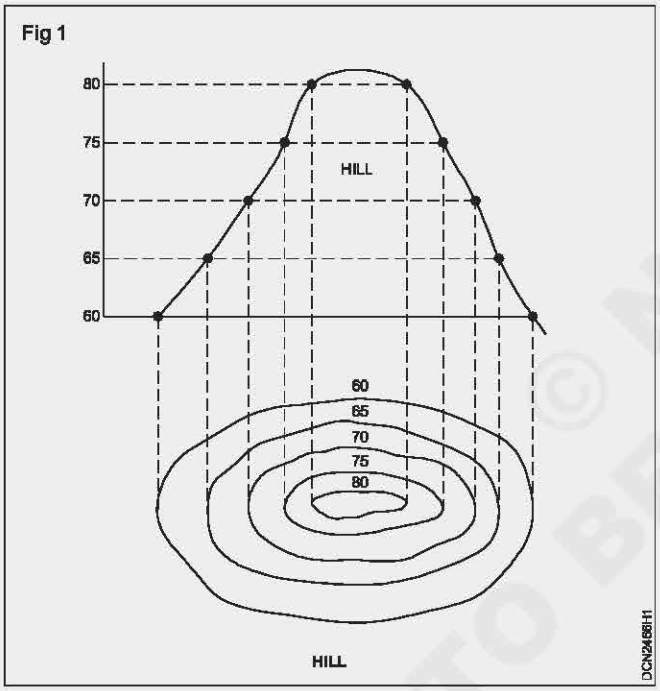
Materials
- Map - 1 No.

Reading a map of contour

In a map,

- In a series of closed contour lines, if the higher values are inside (as in Fig 1), It represents a Hill.

Fig 1



- In a series of closed contour lines, if the higher value are outsides (as in Fig 2) it indicates a Depression.
- In a series of contour lines, if the higher values are inside the a bend or loop, it represents a Ridge line. (Fig .3)
- In a series of contour lines if the higher values are out side the bend it indicates a valley. (Fig 4)
- In a series of contour lines, if the lines are not merging or crossing one another represents a over hanging cliff. (Fig 5)
- 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)

Fig 2

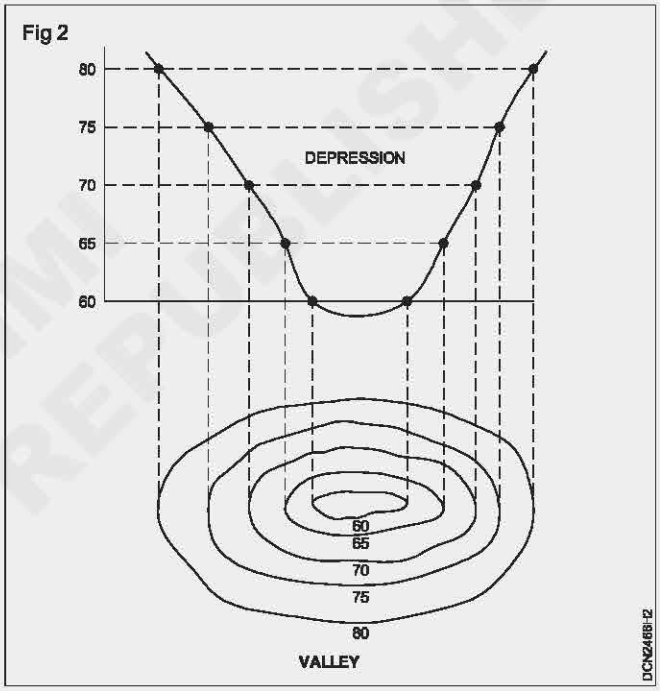
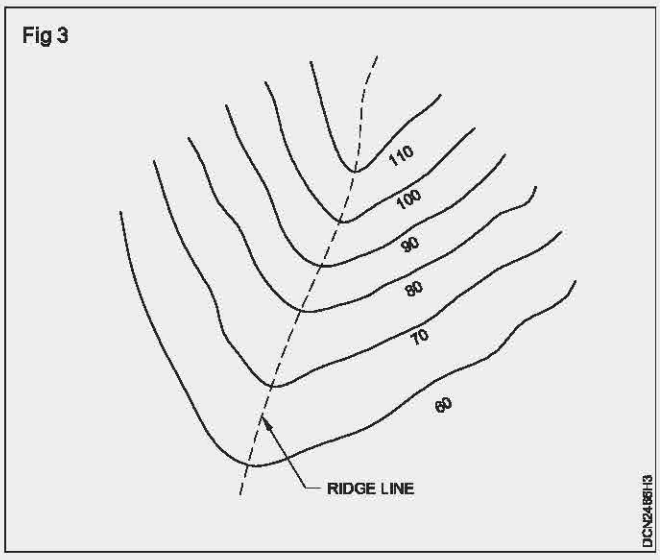


Fig 3



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Fig 4

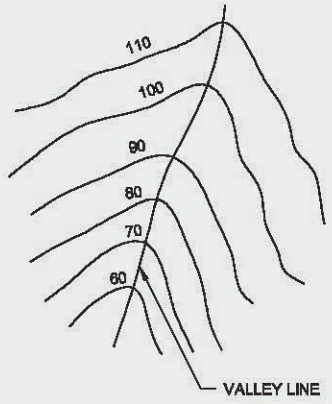


Fig 6

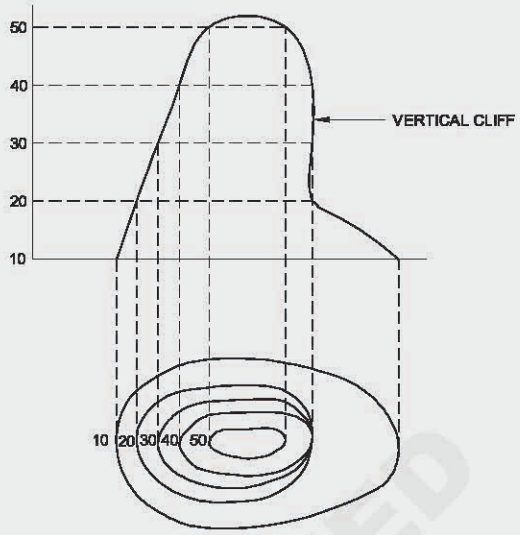
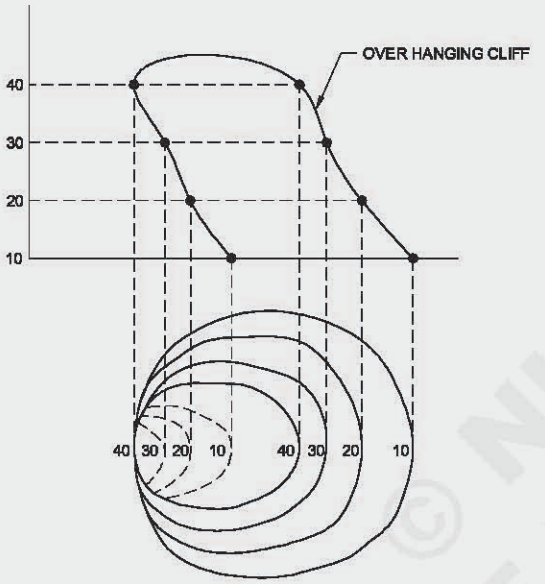
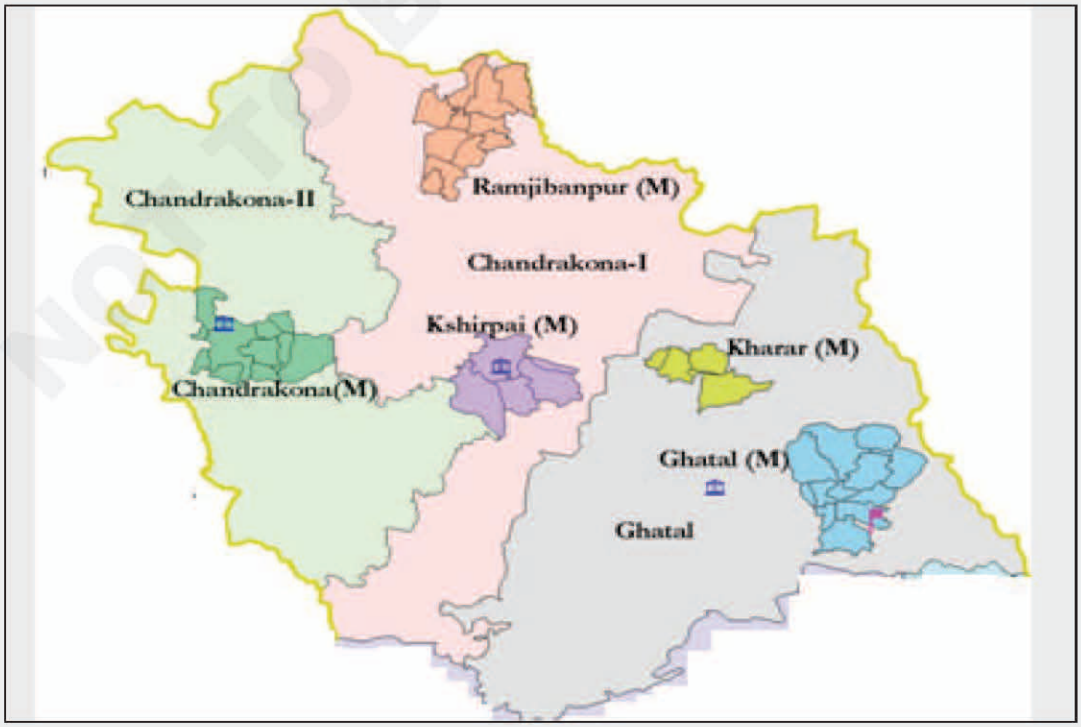


Fig 5





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Exercise 1.16.80

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**
- **identify reduced level of the point Y at the top of the building.**

Requirements

Tools / Instruments

- Theodolite with tripod - 1 No.
- Plumb bob - 1 No.
- Levelling staff - 1 No.
- Hammer - 1 No.

Materials

- White paper - 1 No.
- Measuring tape - 1 No.
- Peg - 1 No.

PROCEDURE

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 verneir 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).

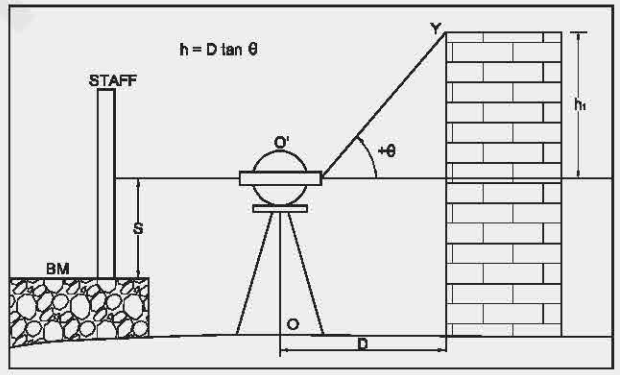
14 Measure the horizontal distance (D) between the instrument station 'O' and base of the point 'Y' using tape.

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



TRIGNOMETRIC LEVELLING

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Tabular column for trignometric levelling

Instru-ment	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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Exercise 1.16.81

Prepare a road map (open traverse)

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

- **prepare a road map with details along the road.**

Requirements

Tools/Equipments/Instruments

- Prismatice compass - 1 No,
- Ranging rods - as reqd.
- Wooden pegs - as reqd
- Chain and tape - 30m - 1 No.
- Eraser - 1 No.
- Set of scale - 1 Set.

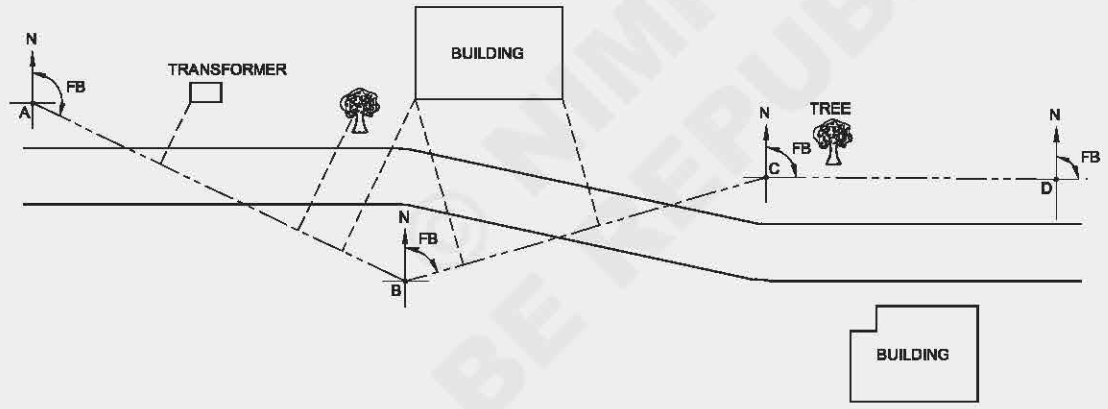
Materials

- Drawing sheet A3 - 1 No.
- Field book - 1 No.
- Pencil HB - 1 No.
- Arrows - 10 Nos.
- Cello tape - 1 roll.

PROCEDURE

TASK 1: **Prepare a road map with details along the road**

Fig 1



PLAN SHOWING THE ROAD PROFILE

DCN2488H1

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.

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Model tabulation

Instrument at	Sight to	Distance in metre	Bearing	Remarks
A	B			AB
B	A			BA
	C			BC
C	B			CB
	D			CD

— — — — — — — —

Road project

Objectives : At the end of this exercise you shall be able to
- **conduct map study**
- **conduct reconnaissance survey**
- **conduct preliminary survey**
- **conduct location survey.**

TASK 1: **Map study**

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.

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TASK 2: **Reconnaissance survey**

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.

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TASK 3: **Preliminary survey**

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.

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TASK 4 : **Location survey**

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.

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TASK 5 : **Construction survey**

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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Familiarization and 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.**

Requirements

Tools / Instruments

- Theodolite with tripod - 1 No each.
- Plumb bob - 1 No.
- Peg - 1 No.
- Hammer - 1 No.

Materials

- White paper - 1 No.

PROCEDURE

- Tripod is placed on a firm ground at a convenient height with the tripod legs set well apart.
- Set two legs of the tripod firmly into the ground.
- Adjust the third leg in circumferential directions so that the top of the tripod becomes approximately horizontal.
- Open the instrument box.
- Note how the instrument is placed in the box.
- Take out the instrument from the box. Hold it with right hand.
- Turning the trivet in clockwise direction, screw the instrument firmly on the tripod.
- Study parts of the theodolite.
- Remove the theodolite from the tripod by turning the trivet in anticlockwise direction.
- Loosen all screws.
- Place the theodolite in the box safely.

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Temporary adjustments of theodolite

Objectives: At the end of this exercise you shall be able to
- **setup the theodolite**
- **level the theodolite**
- **eliminate parallax.**

Setting up

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

One of the legs of the tripod moved radially to bring the plumb bob exactly over the station.

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.

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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.

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.

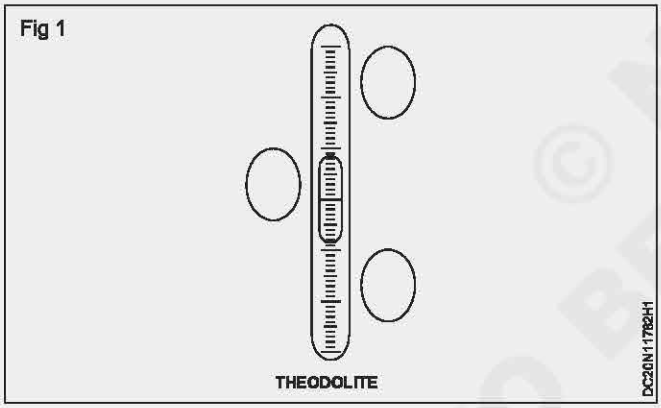
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Permanent adjustment 1 (plate level test)

Objectives: At the end of this exercise you shall be able to
- **establish relation between fundamental axis**
- **perform the plate level test**
- **adjust the instrument.**

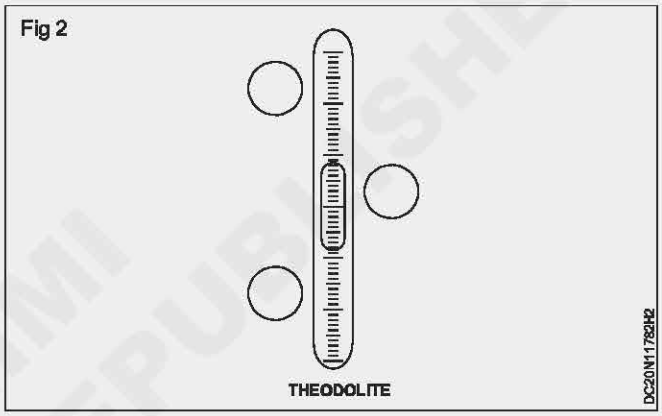
- Fix an instrument station O.
- Set up the instrument over the station O with telescope in normal condition (vertical circle left of the observer and bubble is up).
- Perform all the temporary adjustments.
- Bring the plate bubble parallel to any two foot screws and make the bubbles to its centre of the run (Fig 1)

Fig 1



- Revolve the bubble in the horizontal plane so that the end is reversed. (Fig 2)
- If the bubble is out of the centre, count the number of graduations on the bubble tube.

Fig 2



Adjustment

- Correct half the error by means of pair of leveling screw and the remaining correction is made by means of capstan headed screw provided at the end of the level tube.

Check

- Follow steps 4 to 6 and check whether bubble remains central in two positions and do adjustment if necessary till bubble remains central in any position.

Permanent adjustment 2 (cross hair ring test)

Objectives: At the end of this exercise you shall be able to
- **establish relation between fundamental axes**
- **perform the cross hair ring test**
- **adjust the instrument**.

1 Fix an instrument station O.

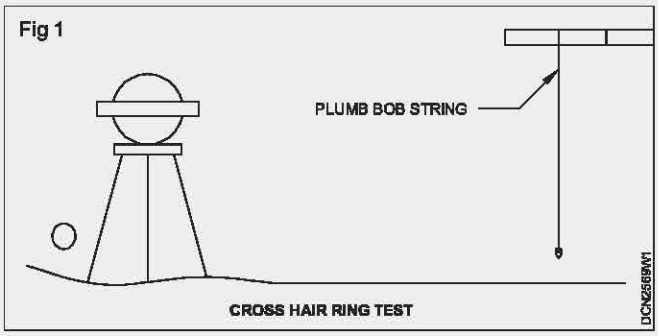
2 Set up the instrument over the station O with telescope in normal condition. (vertical circle left of the observer and bubbles is up)

3 Perform all the temporary adjustments.

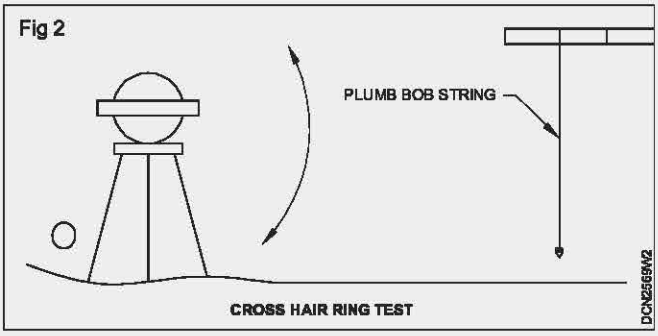
4 Hang a plumb bob at a reasonable distance from the instrument.

5 Direct the telescope and the string of the plumb bob is bisected. (Fig 1)

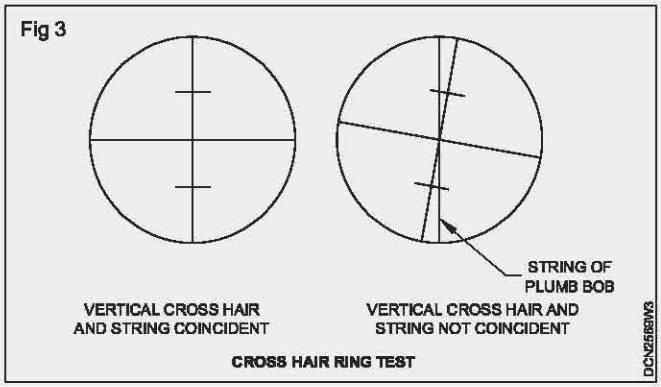
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6 Rotate the telescope in the vertical plane. (Fig 2)



7 If the relative motion of the string is not along the vertical cross hair the instrument needs adjustment. (Fig 3)



Adjustment

- Loosen all four capstan screws on the cross - hair ring, Rotate the ring carefully so that the image of the string and the vertical cross hair coincide.
- The screws are then tightened.

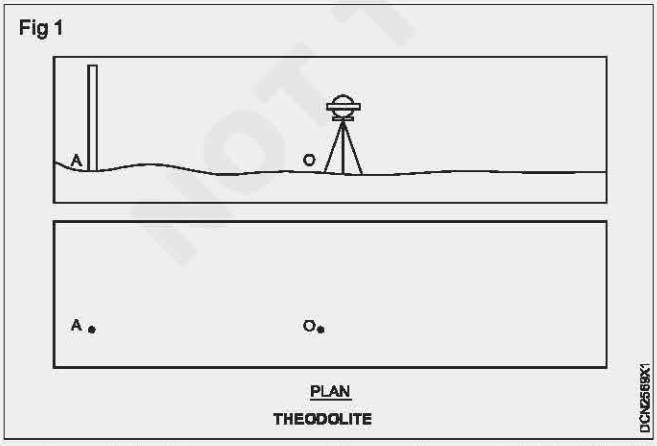
Check

- Follow step 5 to 7 and if necessary adjustment steps till both vertical cross hair and string of plumb bob remains coincident.

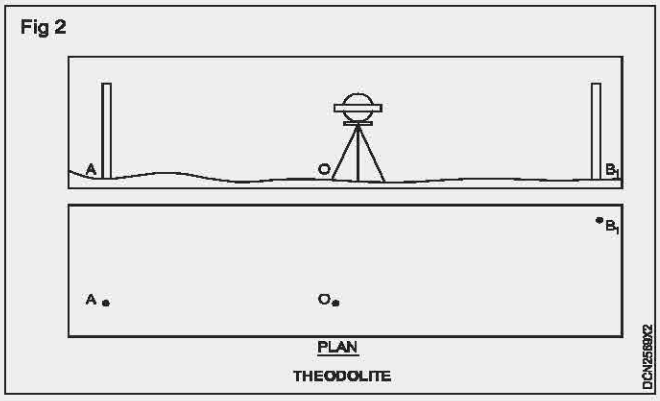
Permanent adjustment 3 (collimation in azimuth test)

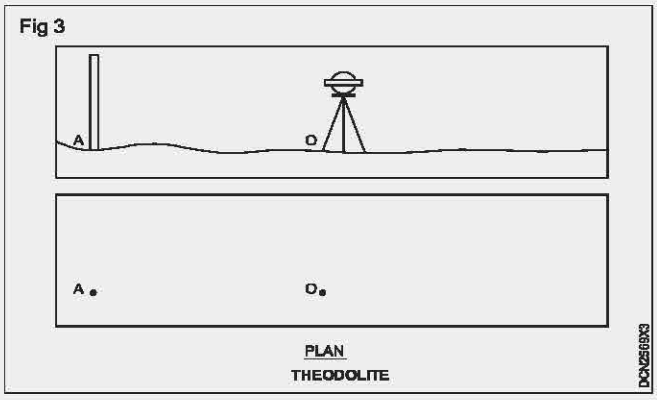
Objectives: At the end of this exercise you shall be able to
- **establish relation between fundamental axes**
- **perform the collimation in azimuth test**
- **adjust the instrument.**

- Fix an instrument station O.
- Set up the instrument over the station O with telescope in normal condition in midway of an open field (should have an unobstructed view of 200m).
- Perform all the temporary adjustments.
- Sight a point, A. (Fig 1)



- Transit the telescope and fix another point, B_1. (Fig 2)
- Change face of the instrument and again bisect the first point, A. (Fig 3)

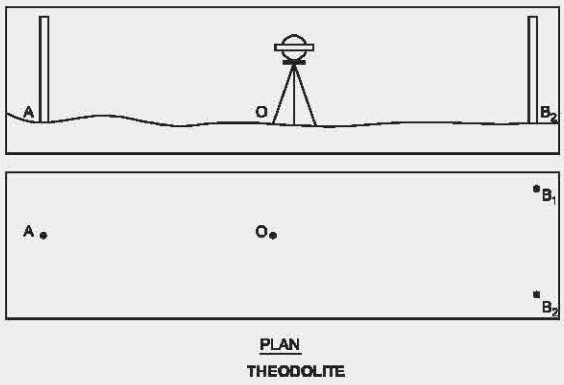




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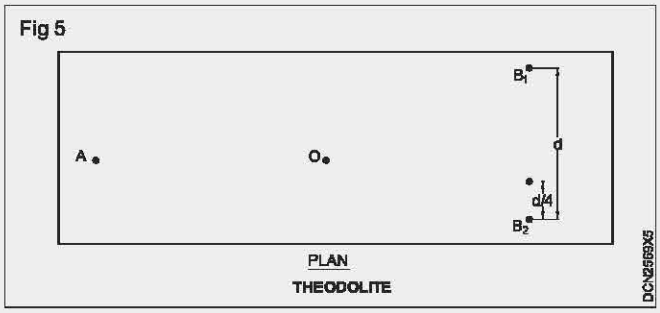
- Transit the telescope. If the line of sight passes through the already fixed point, then the line of sight is perpendicular to the horizontal axis.
- If not fix the new point, B_2. (Fig 4)

Fig 4



- Measure the distance between points.
- Measure a quarter of the distance from the last point. (Fig 5)

Fig 5



Adjustment

- Adjust the vertical hair by means of two opposite capstan headed screws so that the line of sight passes through the quarter distance.

Check

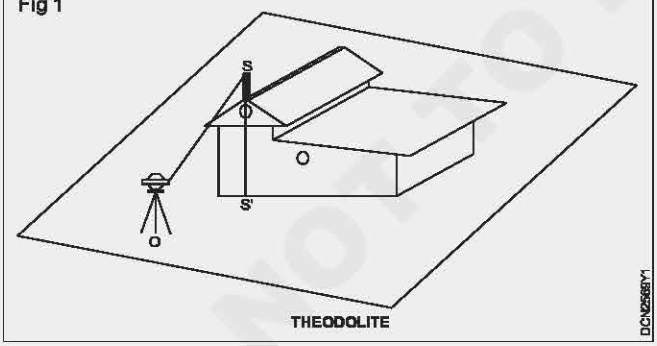
- Repeat the test till line of sight pass through the same point in both face observations.

Permanent adjustment 4 (spire test)

Objectives: At the end of this exercise you shall be able to
- **establish relation between fundamental axes**
- **perform the spire test**
- **adjust the instrument**.

- Fix up the instrument near to any tall object, at an instrument station O.
- Set up the instrument over the station O with telescope in normal condition.
- Perform all the temporary adjustments.
- Sight a well defined point, S. (Fig 1)

Fig 1



- Lower the telescope and find a point on the ground, S'
- Change face of the instrument and again sight S.
- Lower the telescope. (Fig 2)
- If 'S' is sighted then the telescope is in adjustment. If not, instrument needs adjustment.

Adjustment

- Distance between foot distance is measured and mark half the midway between the distance, 'S' (F1 & F2 are the erroneous points sighted in face left and face right observations respectively). (Fig 3)

Fig 2

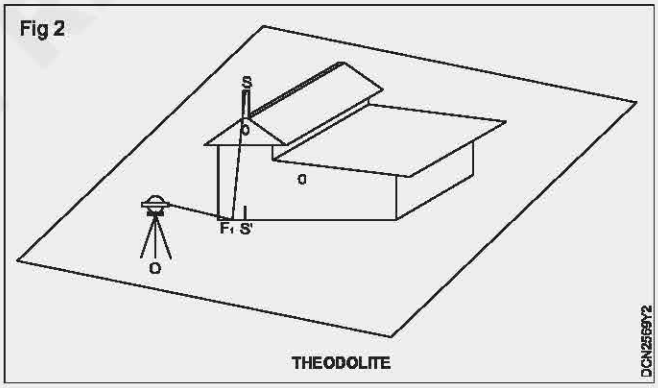
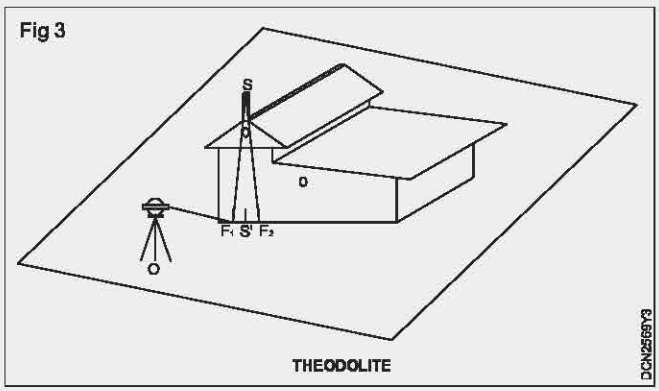


Fig 3



- Centre point is bisected and raise the telescope to sight the point, S.

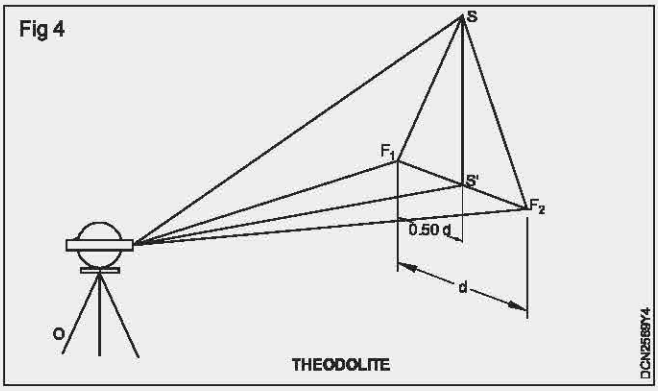
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- One end of the horizontal axis is moved with the adjusting screw until the line of sight bisects the point, S. (Fig 4)

Check

- Repeat the test and check the adjustment.

Fig 4



Permanent adjustment 5 (vertical circle index test)

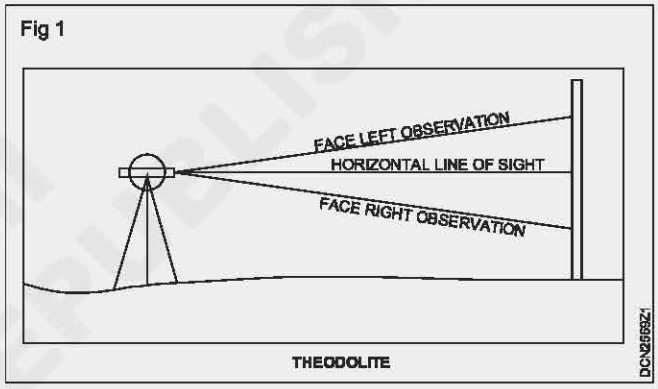
Objectives : At the end of this exercise you shall be able to
- **establish relation between fundamental axes**
- **adjust the instrument.**

- Fix up the instrument near to any tall object, at an instrument station O. (Fig 1)
- Set up the instrument over the station O with telescope in normal condition.
- Perform all the temporary adjustments.
- Set the vertical vernier to zero.
- A staff is held vertical at about 60m from the instrument and the readings is taken by face left observation.
- Then the face is changed and the staff is read again. If there is an error, the face readings will be different.

Adjustment

- The telescope is set to read the mean of the two staff readings.
- Then the vertical circle should be brought back to read zero using the clip screws.

Fig 1



Check

- Repeat the test and perform the adjustment till both face readings remain same while observing.

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Permanent adjustment 6 (vertical arc test)

Objectives: At the end of this exercise you shall be able to
- **establish relation between fundamental axes**
- **perform the vertical arc test**
- **adjust the instrument.**

- Fix up the instrument near to any tall object, at an instrument station O.
- Set up the instrument over the station O with telescope in normal condition.
- Perform all the temporary adjustments.
- Centre the altitude bubble on the telescope.
- The zero of the vernier of the vertical circle should coincide with the zero on the main scale of the vertical circle. If is doesn't coincide, it means is needed adjustment.

Adjustment

- The capstan head screws are loosened and the vernier is moved til the zero coincides with that of the main scale.

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Measuring a horizontal angle (ordinary method)

Objectives: At the end of this exercise you shall be able to
- **operate theodolite**
- **observe and tabulate readings**
- **determine horizontal angle POQ.**

Requirements

Tools/Instruments

- Theodolite with tripod - 1 No each.
- Plumb bob - 1 No.
- Peg - 1 No.
- Hammer - 1 No.
- Ranging rods - 1 No.
- Measuring tape - 1 No.

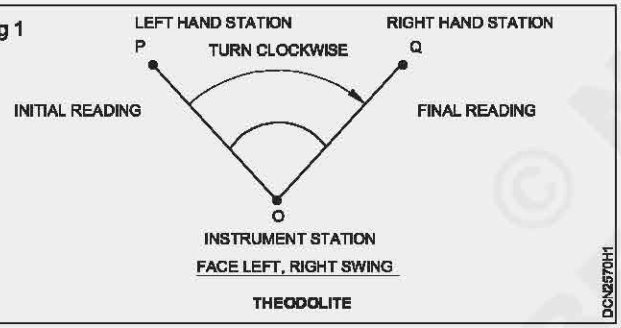
Materials

- White paper - 1 No.

PROCEDURE

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.

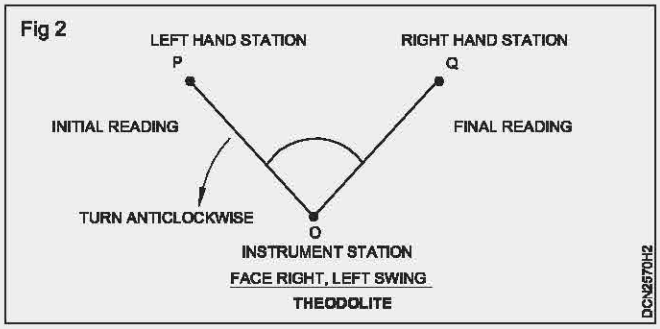
12 Once more check both the verniers A and B and ensure readings remain unchanged.

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.

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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.

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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20 Loosen all clamps. Remove the theodolite from the tripod and gently place it in the box.

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Reading a horizontal angle

Objectives: At the end of this exercise you shall be able to
- **prepare a table for booking the readings**
- **read the Main Scale Reading (M.S.R) and Vernier Scale Reading (V.S.R)**
- **book the readings.**

- Erect an instrument station by driving peg on the ground.
- Loosen strap of the tripod.
- Place the tripod over the station at a convenient height with tripod legs well apart.
- Fix the theodolite over the tripod head. Remove cover of the theodolite.
- Do the temporary adjustments.
- Clamp the plates using lower clamp screw.
- Swing the telescope in clockwise direction to sight the station.
- Tighten the upper clamp. Bisect the station accurately using upper tangent screw.
- Determine value of main scale reading.
- Vernier reading is obtained by locating the reading at which the vernier line coincides with the main scale division.
- Book the readings in column A of the theodolite field book.
- Similarly observed the reading on the scale B and book the readings in respective columns of the field book.
- Find the average of A and B scale readings which is the desired reading.
- Loosen all the clamps and cover the objective. Unscrew theodolite from tripod.
- Gently place theodolite inside the box so that it fits properly.

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Measuring a horizontal angle (Repetition method)

Objectives: At the end of this exercise you shall be able to
- **operate theodolite**
- **check and tabulate readings**
- **determine horizontal angle POQ by repetition method.**

1 Follow the steps 1 to 16 of the exercise - measurement of horizontal angle (ordinary method). (Fig 1)

2 Unlock the lower clamp and swing the telescope in clockwise direction to bisect the station 'P'.

3 Lock the lower clamp. Exact bisection of 'P' is done using lower tangent screw.

4 Once more read the scales and check whether the readings remain unchanged.

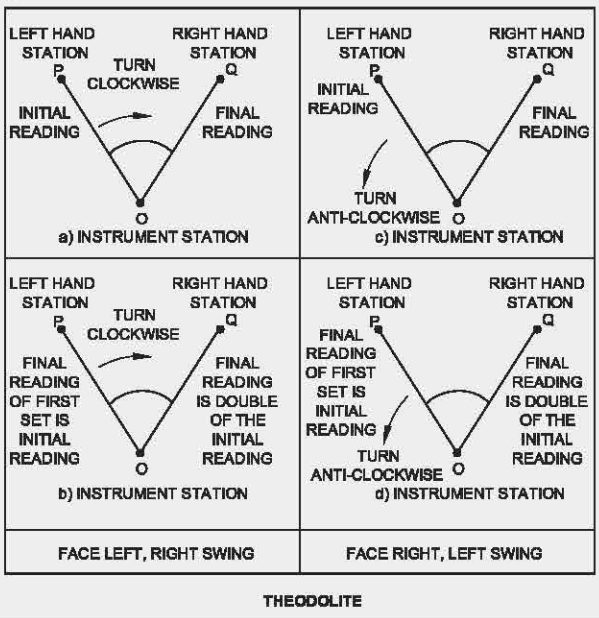
5 Release the upper clamp and swing the telescope to bisect the station 'Q'.

6 Lock the upper clamp. Exact bisection of 'Q' is done using upper tangent screw.

7 Follow the steps for required number of times, say three times and find out the value of angle POQ.

(The average observed reading sighting 'Q' after last repetition divided by the number of repetitions is the angle POQ for the respective face observation)

Fig 1



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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 repetitions	Horizontal angle	A	B	Mean	No.of repetitions	Horizontal angle			
			0 ' "	' "	0 ' "			0 ' "	0 ' "	' "	0 ' "		0 ' "		0 ' "	

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8 Change face of the instrument.

9 Release both upper and lower clamps.

10 Set zero of the vernier coincides with zero of the main scale A.

11 Direct the telescope to sight the left hand station, say 'P' and bisect it.

12 Once more check both the verniers 'A' and 'B' and ensure readings remain unchanged.

13 Enter readings in the respective columns of table.

14 Release the upper clamp and swing the telescope in anticlockwise direction to bisect the right hand station 'Q'.

15 Read and enter readings in the respective columns of the table.

16 Follow steps 5 to 7.

17 Angle POQ is the average of angles obtained from both face observations.

18 Loosen all clamps. Remove the theodolite from the tripod and gently place it in the box.

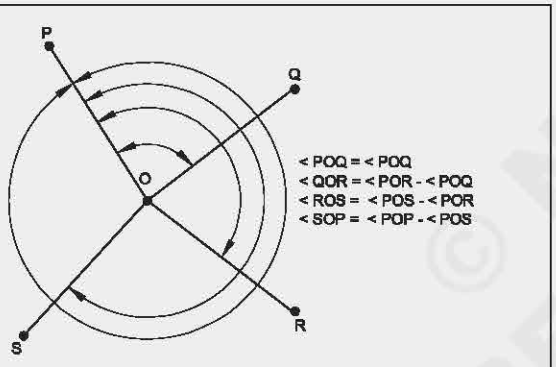
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Measuring a horizontal angle (reiteration method)

Objectives: At the end of this exercise you shall be able to
- **adopt reiteration method**
- **observed and tabulate readings**
- **applying corrections for included angles**
- **determine horizontal angle POQ, QOR, ROS and SOT.**

1 Erect four stations P,Q,R and S by driving pegs on the field and erect ranging rods vertically behind the pegs. (Fig 1)

Fig 1



2 Fix an instrument station 'O' so as to get complete sight of the stations.

3 Follow steps 3 to 16 of exercise - measurement of horizontal angle (ordinary method).

4 Release the upper clamp and swing the telescope to bisect the station 'Q'.

5 Lock the upper clamp and get exact bisection using upper tangent screw.

6 Read and enter readings in the respective columns of the table.

7 Release the upper clamp and swing the telescope to bisect the station 'R'.

8 Lock the upper clamp and get exact bisection using upper tangent screw.

9 Read and enter readings in the respective columns of the table.

10 Similarly bisect stations 'S' using upper clamp screws and its tangent and enter readings in the respective columns.

11 Finally close the horizon (sight the station P) and observed the reading.

12 Change face of the instrument and follow steps 5 to 16 of exercise - measurement of horizontal angle. (ordinary method)

13 Follow above steps 4 to 11.

14 Determine average horizontal angles POQ,QOR, ROS and SOP.

15 (Apply corrections, if closing error exists)

If the value of angle measured at p (after closing horizontal if more than 360°, divide the discrepancy equally and subtract from the each of the included angle calculated if it is less than 360°, divide the difference equally and add it.

16 Loosen all clamps. Remove the theodolite from the tripod and gently place it in the box.

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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 repetitions	Horizontal angle	A	B	Mean	No.of repetitions	Horizontal angle				
			0 ' "	' "	0 ' "		0 ' "	0 ' "	' "	0 ' "		0 ' "			0 ' "	

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Measuring a vertical angle (Angle of Elevation)

Objectives: At the end of this exercise you shall be able to
- **operate theodolite**
- **observe and tabulate readings**
- **measure the vertical angle (a).**

Requirements

Tools/Instruments

• Theodolite with tripod	- 1 No each
• Plumb bob	- 1 No.
• Peg	- 1 No.
• Hammer	- 1 No.
• Ranging rods	- 1 No.
• Measuring tape	- 1 No.

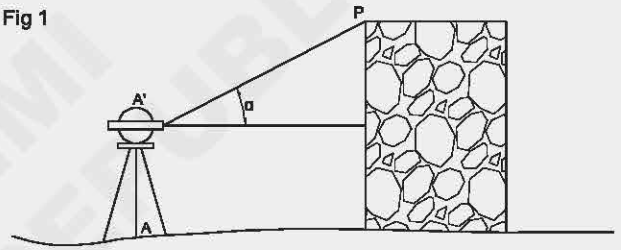
Materials

• White paper	- 1 No.

PROCEDURE

- Erect a station a by driving peg on an open and fair ground.
- Set up the instrument at A. (Fig 1)
- Perform all the temporary adjustments.
- 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)
- Direct the telescope upwards to sight 'P' (Fig 2)
- Lock horizontal movement of plates.
- Tighten vertical clamp screw.
- Bisect 'P' exactly using tangent screws.
- Measure vertical angle, +a from C scale and D scale.
- Record the readings with sign.
- Mean reading is the vertical angle.
- Change face of the instrument and measure vertical angle following appropriate above steps.
- Average of both face readings is the angle of elevation (+a) to 'P' from 'A'.

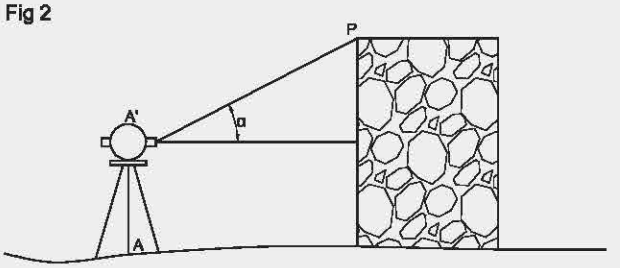
Fig 1



MEASURING VERTICAL ANGLE (FACE RIGHT)

DCN2571H1

Fig 2



MEASURING VERTICAL ANGLE (FACE RIGHT)

DCN2571H2

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INSTRUMENT	SIGHT TO	FACE LEFT						FACE RIGHT						Averager vertical	Rough sketch
		A		B	MEAN		HORIZONTAL ANGLE	A		B	MEAN		HORIZONTAL ANGLE		
		0 ' "		' "	0 ' "		0 ' "	0 ' "		' "	0 ' "		0 ' "		

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Measuring direct angles

Objectives: At the end of this exercise you shall be able to
- **operate theodolite**
- **observe and tabulate readings**
- **determine direct angles PQR,QRS and RST.**

Instrument	Sight to	Length (m)	Face left Right Swing												Face Right Left Swing												Average Horizontal Angle			Remarks	Rough
			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	'	"		
P	Q																													BEARING OF PQ=	

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1 Erect five stations P,Q,R,S and T by driving pegs on the field and erect ranging rods vertically behind the pegs P and R. (Fig 1 & 2)

2 Follow steps 2 and 3 of the exercise - measurement of deflection angle.

3 Follow the steps 4 to 12 of exercise - measurement of horizontal angle (ordinary method).

4 Release the upper clamp and swing the telescope in the clockwise direction and bisect the station 'R'

5 Lock the upper clamp and get exact bisection using upper tangent screw.

6 Read and enter readings in the respective columns of the table.

7 Transit the telescope, unclamp the lower clamp and bisect P.

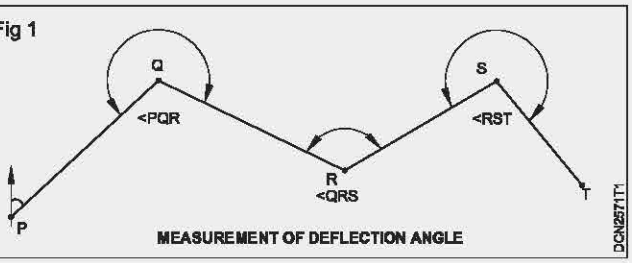
8 Lock the lower clamp and using tangent screw bisect P accurately. Ensure readings remain unchanged.

9 Unclamp the upper plate. Swing the telescope and bisect the station R.

10 Clamp upper plate. Bisect R accurately using upper tangent screw. Observe the readings.

11 Average of this value is the value of the required angle PQR.

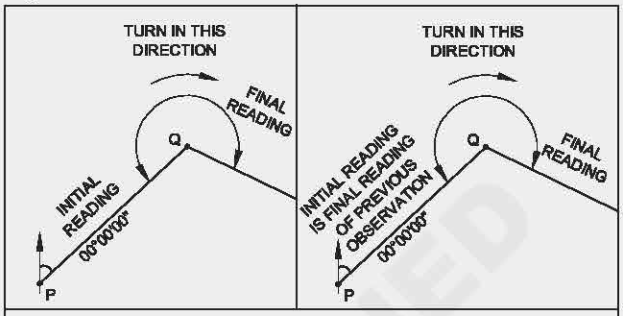
Fig 1



MEASUREMENT OF DEFLECTION ANGLE

DCN2571T1

Fig 2



DIRECT ANGLE AT STATION Q (TWO REPETITIONS)

MEASUREMENT OF DEFLECTION ANGLE

DCN2571T2

12 Similarly measure angles QRS and RST from stations R and S respectively.

13 Loosen all clamps. Remove the theodolite from the tripod and gently place it in the box.

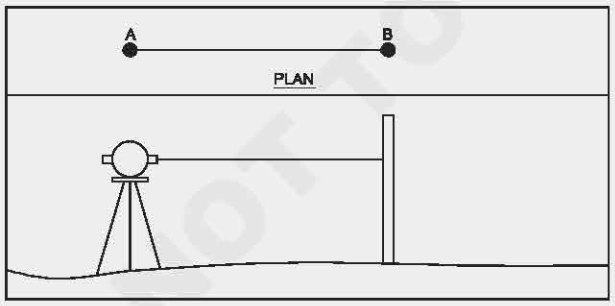
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Setting out a straight line

Objectives: At the end of this exercise you shall be able to
- **set up the theodolite**
- **set up a line AB of length 20m.**

- Set a line AB of reasonable length on the ground and erect pegs at the ends of this line. (Fig 1 & 2)

Fig 1

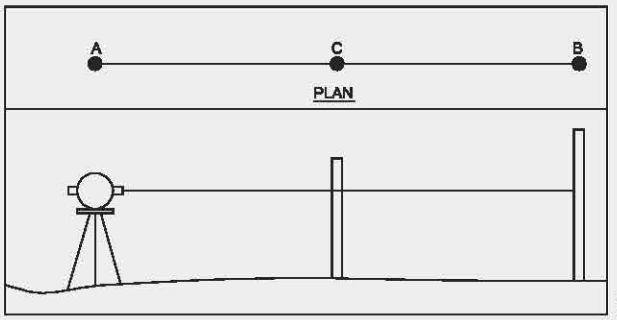


SETTING OUT A STRAIGHT LINE

DCN2571U1

- Drive a peg on the ground at A and set up the instrument over the station A.
- Perform all the temporary adjustments.
- After fixing horizontal motion direct the telescope towards the required direction of the line to be set out.
- Hold zero end of the tape at A.

Fig 2



SETTING OUT A STRAIGHT LINE

DCN2571U2

- Direct a survey man with ranging rod and 20m end of the tape, along the line of sight and fix the required end point, B, of the line.
- Exactly bisect the ranging rod and fix the point, B, by driving peg.
- Loosen all clamps. Remove the theodolite from the tripod and gently place it in the box.

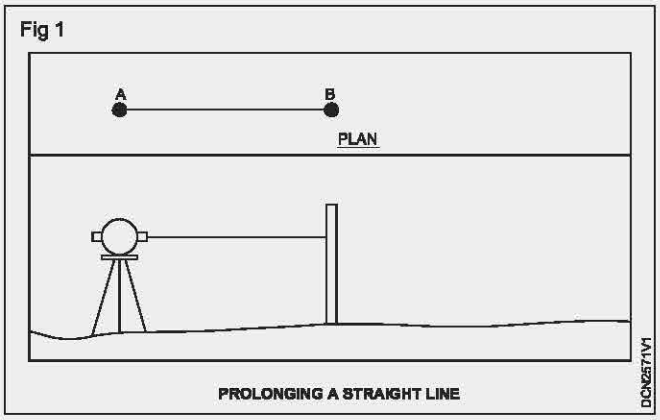
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Prolonging a straight line

Objectives: At the end of this exercise you shall be able to
- **set out a line AB**
- **prolong the line AB**
- **erect two points C and D on prolonged line by double sighting.**

1 Set a line AB and erect pegs at the ends of this line. (Fig 1)

Fig 1



2 Set up the instrument over the station A.

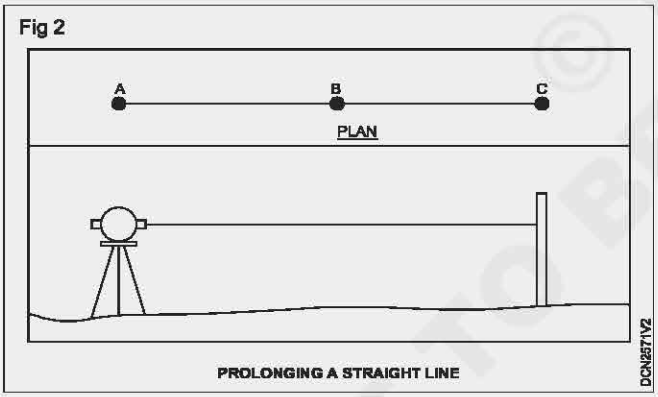
3 Perform all the temporary adjustments.

4 Bisect station B accurately with tangent screws after fixing horizontal motion (clamp plates).

5 Move the telescope in vertical plane and looking through the pin and hole arrangement direct the surveryor, with ranging rod, in line.

6 Set up the theodolite over B. (Fig 2)

Fig 2



7 With both screws clamped backsight A.

8 Transit the telescope.

9 Exactly bisect the ranging rod and fix the point, C, by driving peg. (Fig 3)

10 Change face of the instrument. Follow steps 4 to 9.

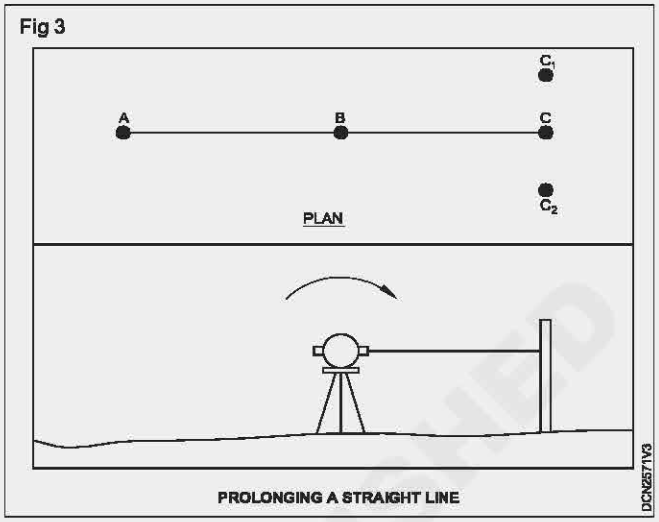
11 If instrument is in perfect adjustment C will be sighted. Other wise locate new point, say C_2 and previous sighted point C_1.

12 Measure C_1 C_2 Find middle of C_1 C_2 which is the required point C, in line with AB.

13 Move the instrument to C. (Fig 4)

14 Similarly following above steps fix another point D. (Fig 5)

Fig 3



15 Loosen all clamps. Remove the theodolite from the tripod and gently place it in the box.

Fig 4

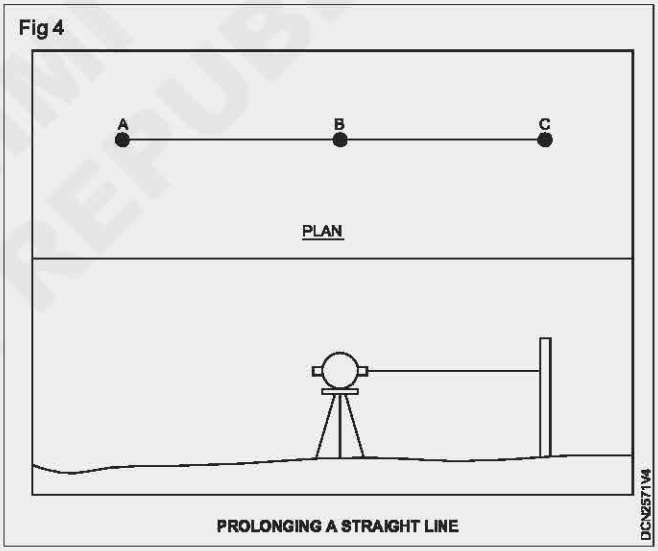
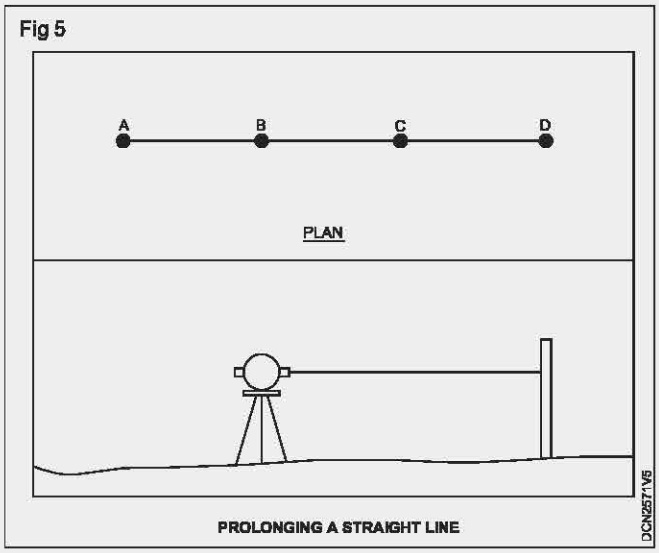


Fig 5



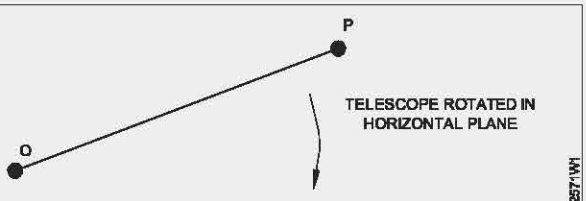
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Establishing a line at given angle

Objectives: At the end of this exercise you shall be able to
- **set given angle in theodolite**
- **set out the given angle POQ on the field**
- **establish line along the set out angle.**

1 Erect a station, P, by driving pegs on the field and erect ranging rods vertically behind the pegs. (Fig 1)

Fig 1



ESTABLISHING A LINE AT GIVEN ANGLE

2 Fix an instrument station O.

3 Set up the instrument over the station O with telescope in normal condition.

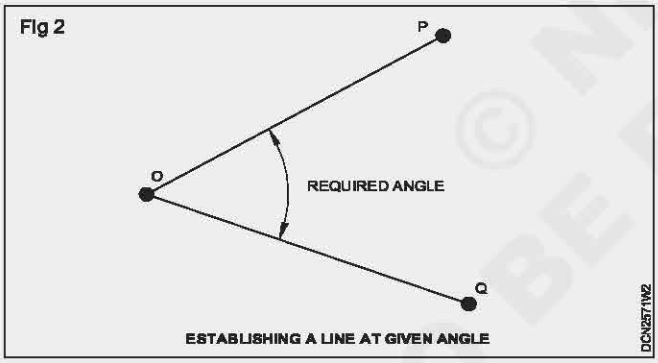
4 Perform all the temporary adjustments.

5 Releases both upper and lower clamps.

6 Turn the upper plate until the index of vernier of 'A' exactly coincides with the zero of the main scale.

7 Direct the telescope to sight the ranging rod at the left hand station (P) and bisect the station. (Fig 2)

Fig 2



ESTABLISHING A LINE AT GIVEN ANGLE

8 Lock the lower clamp.

9 Bisect the station P exactly by using the tangent screw.

10 Once more check both the vernier A and B and ensure readings remain unchanged.

11 Loosen the upper clamp.

12 Turn the telescope in the clockwise direction to set the horizontal angle as per given value. Lock the upper clamp. (or turn the telescope in anti clockwise direction)

13 Exact setting of the angular value is done using upper tangent screw.

14 Direct the surveyor man with ranging rod (required length can set out following steps described in previous exercise) along the line of sight and fix the point, Q on the ground along the line of sight.

15 Check the angular value and the point, Q sighted.

16 Drive a peg on the ground.

17 For more accurate position, continue the operation, after changing the face and rotating in anti clock wise swing. if both are same position the instrument is in good condition or not, take the average if the two value.

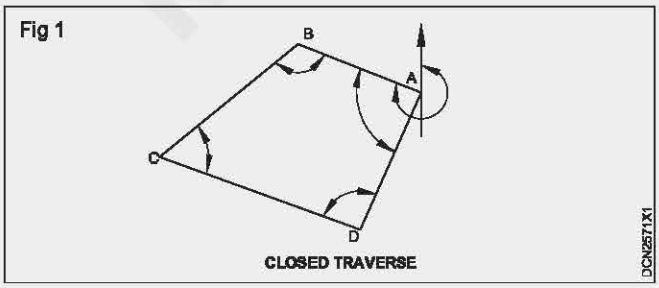
18 Loosen all clamps. Remove the theodolite from the tripod and gently place it in the box.

Closed traverse

Objectives: At the end of this exercise you shall be able to
- **measure the included angles**
- **balance the closed traverse ABCDA**
- **plot the traverse using coordinates.**

1 Reconnaissance the area to be surveyed. (Fig 1)

Fig 1



CLOSED TRAVERSE

2 Select station as per field conditions.

3 Mark the stations.

4 Take at least three permanent reference points of the stations.

5 Set up the instrument at the starting station, say 'A'.

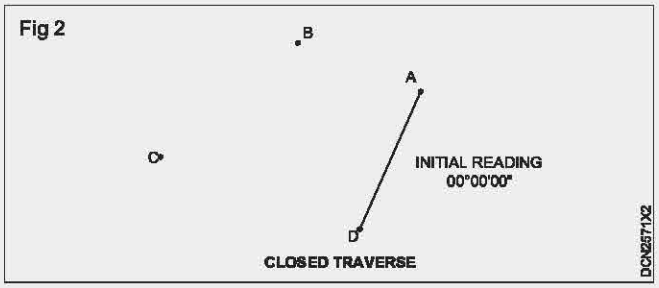
6 Set the vernier scale A, 0-0.

7 Perform all the temporary adjustments.

8 Measure the magnetic meridian of the line AB using theodolite if it is fitted with magnetic compass (other wise use prismatic compass). (Fig 2)

9 Loosen the lower clamp; direct the telescope towards the last back sight station D.

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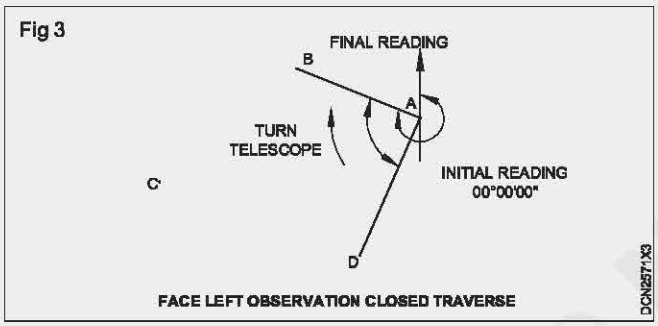
10 Tighten lower clamp and bisect the station exactly using the lower tangent screw.

11 Loosen upper clamp; telescope is turned to sight the forward station 'B'.

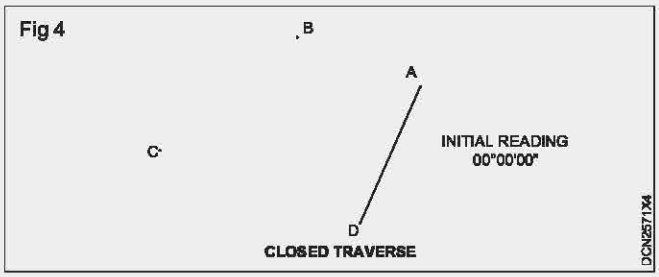
12 Tighten upper clamp; Bisect 'B' exactly and observe the horizontal angle.

13 Following appropriate above steps observe a face right reading (accuracy can be improved by adopting repetition method).

14 Measured horizontal angles by both face observations at each station. (Fig 3)



15 Measure the length of the side. (Fig 4)

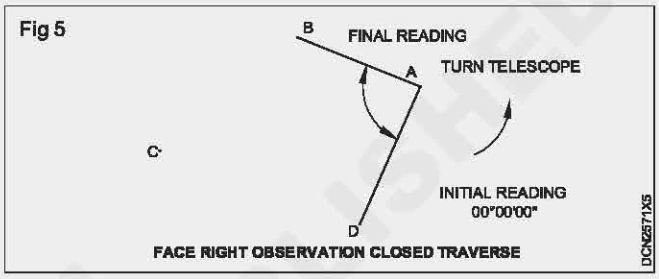


16 Proceed thus to finish off the traverse.

17 Calculate the coordinates.

18 Arithmetically balance the traverse if error exists

19 Plot the traverse using coordinates. (Fig 5)



20 Balance the traverse graphically if traverse failed to close while plotting.

Open traverse

Objectives: At the end of this exercise you shall be able to
- **measure the angles between the traverse lines.**
- **check the traverse**
- **plot the open traverse.**

PROCEDURE

1 Reconnaissance the area to be surveyed. (Fig 1)

2 Select stations as per field conditions.

3 Mark the stations.

4 Take at least three permanent reference points of the stations.

5 Set up the instrument at he 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 (other wise 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 describe 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. (measure 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.

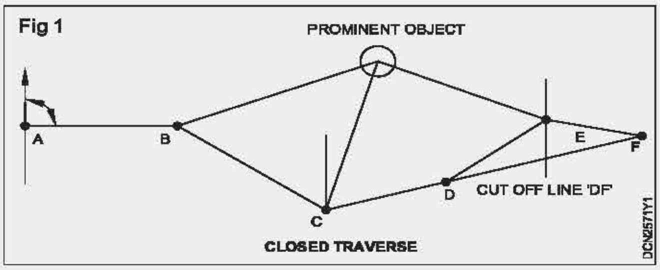
18 Plot the traverse to a suitable scale.

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Instru ment	Sight to	Length (m)	Face left Right Swing												Face Right Left Swing															Remarks	Rough
			A			B		Mean			No of repti tions	Horizontal angle			A			B		Mean			No.of repti tions	Horizontal angle			Average Horizontal Angle				
			0	‘	“	‘	“	0	‘	“		0	‘	“	0	‘	“	‘	“	0	‘	“		0	‘	“	0	‘	“		
P	Q																													BEARING OF PQ=	

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Fig 1



CLOSED TRAVERSE

Instrument	Sight to	Length (m)	Face left												Face Right												Average Horizontal Angle			Remarks	Rough Sketch
			Right Swing												Left Swing																
			A			B		Mean			No of repti tions	Horizontal angle			A			B		Mean			No.of repti tions	Horizontal angle							
			°	'	"	'	"	°	'	"		°	'	"	°	'	"	'	"	°	'	"		°	'	"	°	'	"		
P	Q																													BEARING OF PQ=	

Magnetic bearing of a line

Objective : At the end of this exercise you shall be able to
- **setting up the theodolite for magnetic bearing of line.**

Requirements

Tools / Instruments

- Theodolite with tripod - 1 No each.

Materials

- White paper - 1 No.
- Pencils - 1 No.
- Paper - 1 No.

PROCEDURE

TASK: **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 trought 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 clam. 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 face take a second reading and record the mean of the two.

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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

1 Find suitable ground point so that the points to be sighted can be well commanded. (Fig 1)

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.

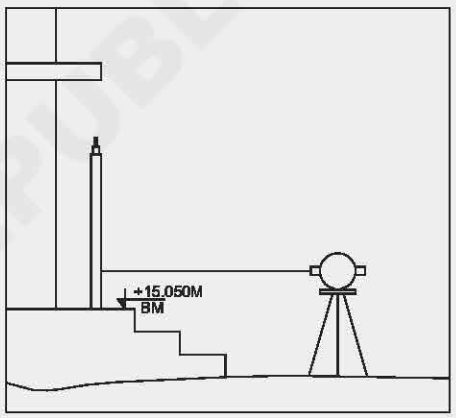
8 Arrest the horizontal motion. Exact bisection is done using the lower tangent screw.

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.

Fig 1



SIMPLE LEVELLING

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 roading taken just before changing the HI of instrument , FS)

16 Find the reduced levels of the points by any of the methods.

— — — — — — — —

Trignometric 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.**

1 Select an instrument station 'O' on a fairly open ground at a reasonable distance from the base of 'Y'. (Fig 1)

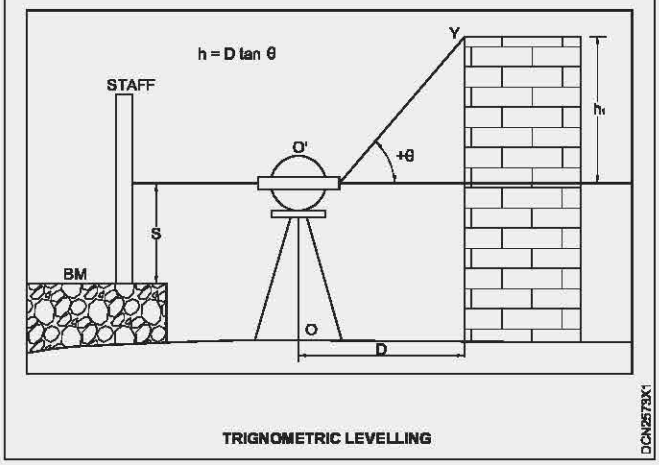
2 Set up the instrument at 'O'.

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3 Perform all the temporary adjustments.

4 Set the vertical vernier 0-0.

Fig 1



TRIGNOMETRIC LEVELLING

5 Direct the telescope to the staff vertically held 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 (?) in both scales and enter it in the respective column. (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 (?).

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'.

Tabular column for trignometric levelling

Instrument	Sight to	Length (m)	Face Left						Face Right						Average vertical			Rough sketch
			C		D		Mean	Vertical angle	C		D		Mean	Vertical angle				
			°	'	"	'	"	° ' "	°	'	"	'	"	° ' "	°	'	"	

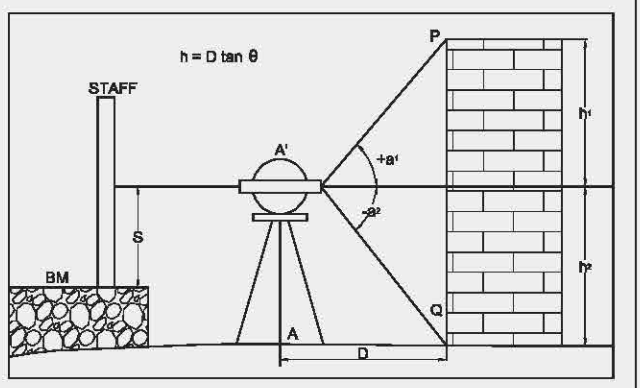
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Find reduced levels of the points

Objectives: At the end of this exercise you shall be able to
- **operate the instrument**
- **determine RLs**
- **determine vertical angle between two lines of sight.**

1 Erect a station a by driving peg on an open and fair ground. (Fig 1)

Fig 1



2 Set up the instrument at A.

3 Perform all the temporary adjustments.

4 Set the vertical vernier 0-0.

5 Direct the telescope to the staff vertically held at the given BM (check altitude bubble).

6 Clamp both plates. Exactly bisect the staff.

7 Direct the telescope to sight 'p'.

8 Lock horizontal movement of plates.

9 Tighten vertical clamp screw.

10 Bisect 'p' exactly using tangent screws.

11 Measure vertical angle, +a1 from C scale and D scale.

12 Record the readings with sign.

13 Mean reading is the vertical angle.

14 Direct the telescope to sight 'Q'.

15 Follow above steps 6 and 7.

16 Bisect 'Q' exactly using tangent screws.

17 Measure vertical angle, -a2 from C scale and D scale

18 Record the readings with sign.

19 Mean reading is the vertical angle.

20 Change face of the instrument and follow appropiate above steps.

21 Average of both face readings is the required angles +a1 and -a2.

22 Algebraic difference of +a1 and -a2 is the required vertical angle.

23 Measure the horizontal distance between the instrument station and the points. (both in the same vertical plane)

24 Final RL of P and Q

RL of P = RL of BM + Staff reading on BM +h1

RL of Q = RL of BM + Staff reading on BM -h2

25 Find vertical angle between P and Q at 'A'.

Instrument	Sight to	Lenght (m)	Face Left									Face Right									Average Vertical Angle			Rough Sketch
			C			D			Mean			Vertical Angle			C			D			Mean			Vertical Angle						

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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.**

Requirements

Tools / Instruments
- Nil

Materials
- White paper - 1 No.

TASK 1: **Calculate the independent co-ordinates**

Given the altitude and departures of the sides of a closed traverse ABCD.

Side	Latitudes in Metres		Departre 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 possitive.

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
(Assisment)

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-ordiante of C = 264.90
Deduct westing of D = 45.00
East co-ordinates of D = 219.90
Deduct westing of A = 119.90
Check east co-ordinate fo A (same as answered) = 100.00

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TASK 2: **Calculate the area of traverse ABCD**

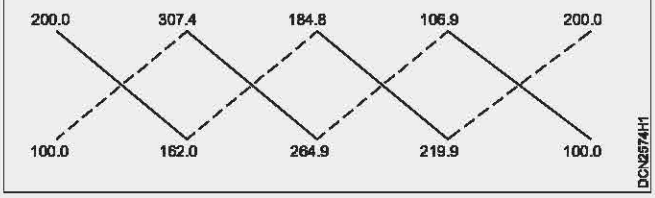
The independent co-ordinates of points are

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

Arrange the co-ordiantes. in the determinate form. (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.

Fig 1



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Determination of height

Objectives: At the end of this exercise you shall be able to
- **the base of the object is accessible**
- **the base of the object is in accessible.**

Requirements

Tools / Instruments

- Theodolite with tripod - 1 No each.
- Plumb bob - 1 No.
- Peg - 1 No.
- Hammer - 1 No.

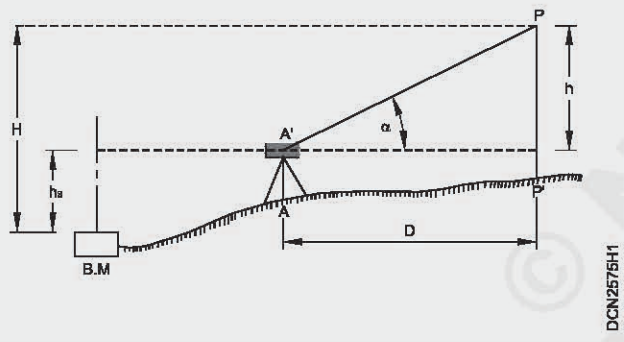
Materials

- White paper - 1 No.

TASK 1: **When the base of the object is accessible**

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 metress 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

$$0.0673 \left(\frac{D}{1000}\right)^2$$

- Apply the above formula.
- Find the height of the object above the instrument station.
- Add the height of the instrument axis to the height of the object above the instrument axis.
- Obtained the height of the instrument axis in the wags.
- Measure the height of centre of the eye - piece above the station point by steel tape.
- Read the staff through the object - glars when held just near the eyes - piece end.

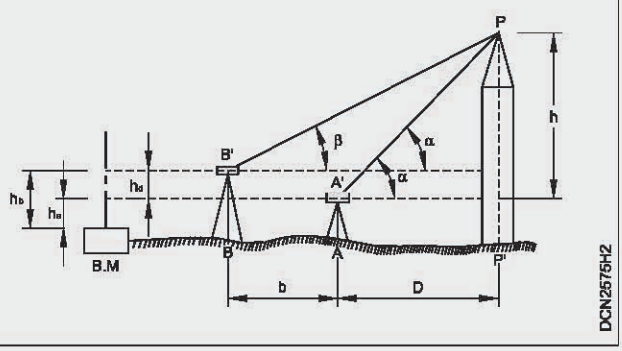
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TASK 2: **When the base of the object is inaccessible (Fig 2)**

- Find the height of the object above a Bench mark. (B.M)
- Choose two stations A and B suitable on level ground.
- Set up the instrument over the station A and level it accurately.
- Set the altitude bubble centre.
- Set the vertical vernier reading zero.
- Take a reading on the start held on B.M (or) reference point.
- Bisect the object P and read both vernier.
- Change the face again sight P and read both verniers.
- Take mean of the four readings, which is correct the value of the vertical angle.
- Shift the instrument to B and take similar observations as A.

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Fig. 2



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.

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 them 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

$$\text{or } D = \frac{b \tan B + h_d}{\tan \propto - \tan B}$$

put this value of D in (i)

$$h = \frac{b \tan B + h_d}{\tan \propto - \tan B} \cdot \tan \propto$$

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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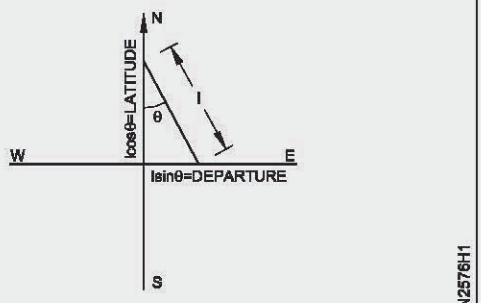
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Calculate of departure, altitude, northing and easting

Objective : At the end of this exercise you shall be able to
- **calculate of departure, altitude, northing and easting.**

TASK 1: **Calculate of departure altitude 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) $\tan\theta = \frac{\text{depature}}{\text{latitude}}$

(or)

$$\theta = \tan^{-1}\frac{\text{depature}}{\text{latitude}}$$

(iii) (a) $l = \sqrt{\text{latitude}^2 + \text{depature}^2}$

(b) l =latitude x secθ

(c) l = departure × cosecθ

Example:

The co-ordinates of two points A and B are given

Point	co-ordinates	
	Northig	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

Depature of AB = the difference between, the east co-ordinates of A and B = 315.60-640.75=-325.15

$$\therefore \tan\theta = \frac{\text{depature}}{\text{latitude}} = \frac{325.15}{340.53} = 0.9548$$

$\therefore$ θ = 43° - 41'

Since the latitude is +ve and the daparture is -ve.

The line AB lines in the fourth

(N.W.) quadrant.

R.B of AB = N 43°41' W

W.C B of AB = 360° - 43° 41'

= 316° 19'

$$\text{Length of AB} = \sqrt{(L)^2 + (D)^2}$$
$$= \sqrt{(340.53)^2 + (325.15)^2}$$

= 470.83m.

Check length of AB = latitude of AB x secθ.

= 340.53 x sec 43° 41'

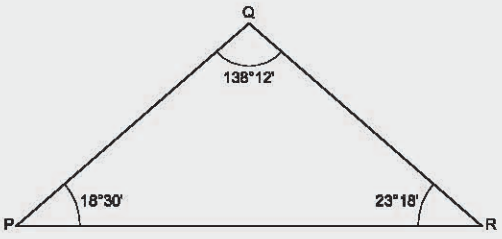
= 470.88m.

Example:

Included angle of the triangle PQR (Fig 2) $\angle QPR$ = bearing of PR - Bearing of PQ.

= 37° 6'-18' 36' = 18° 30'

Fig. 2



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$\angle RQP$ = Bearing of QP = Bearing of QR = 198^0 36' - 60^0 24' = 138^0 12'

$\angle PRQ$ = Bearing of RQ - Bearing of RQ - Bearing of RP. = 240^0 24' - 217' 6' = 23^0 18'

Check: $\angle P + \angle Q + \angle R = 18^0 30' + 138^0 12'$ + 23^0 18' = 180^0 00'

Length of PQ and QR.

Apply line rule;

$$\frac{PR}{Sin\angle Q} = \frac{PQ}{Sin\angle R} = \frac{QR}{Sin\angle P}$$

$$PR = \frac{PR \times Sin\angle R}{Sin\angle Q} = \frac{1421 \times Sin\ 23^0 18'}{Sin\ 138^0 12'}$$

$$= \frac{1421 \times 0.3955}{0.6665} = 843.22\ m$$

$$QR = \frac{PR \times Sin\angle P}{Sin\angle Q} = \frac{1421 \times Sin\ 18^0 30'}{Sin\ 138^0 12'}$$

$$= \frac{1421 \times 0.3173}{0.6665} \times 676.49\ m$$

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Setting out work for building, culvert, centerline of dams bridges and slope of earth work

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 / 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.

TASK 1: **Setting out work for building**

- Set the theodolite at the site.
- Instructor should demonstrate construction of proposed building survey.
- He should emphasize presafety precautions and operational safety precautions to be observed during survey.
- He should also state post safety precautions to be observed.
- After his demo of the theodolite at site from the proposed construction of the building trainees should repeat the same.
- 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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