INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

COMPUTER AIDED BUILDING DRAFTING LABORATORY								
IV Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ACEE18	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Computer Aided Engineering Graphics								

I. COURSE OVERVIEW:

The Computer Aided Building Drafting Laboratory course focuses on the practical application of building planning and architectural drafting using CAD tools. Students engage in hands-on exercises to develop proficiency in preparing building layouts, sections, elevations, and detailed component drawings. The lab offers a structured environment for applying National Building Code (NBC) guidelines, building by-laws, and drafting standards to real-world architectural scenarios. Through systematic practice in building design and digital documentation, students enhance their technical accuracy, spatial visualization, and drafting efficiency. This course equips learners with essential CAD skills for producing professional construction drawings and fosters a solid foundation for advanced architectural and structural drafting tasks in future coursework and field practice.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The planning principles and building by-law requirements necessary for drafting residential and public building layouts in accordance with National Building Code (NBC) standards.
II. The use of computer-aided design (CAD) tools to create accurate plans, sections, elevations, and component drawings of various building systems.
III. The techniques for developing professional working drawings with proper dimensioning, annotations, title blocks, and layout plotting for architectural communication.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO 1 Interpret planning guidelines and building regulations as per the National Building Code (NBC) to prepare compliant building layouts.
CO 2 Draft brick bonding patterns and building components such as doors, windows, staircases, and footings using CAD tools.
CO 3 Develop architectural plans, sections, and elevations for residential and public buildings using standard drafting conventions.
CO 4 Apply building by-laws and functional planning principles to design single and multi-storeyed building layouts.
CO 5 Prepare center line diagrams and site plans with correct dimensioning, orientation, and setback provisions.
CO 6 Prepare complete working drawings with proper annotations, title blocks, and layout settings suitable for professional submission.

IV. COURSE CONTENT:

1. PLANNING ASPECTS OF BUILDING SYSTEMS AS PER NBC

Planning of building systems is an important step in architectural design that ensures proper arrangement of spaces, safety, functionality, and user comfort. The National Building Code of India provides guidelines related to room dimensions, ventilation, lighting, sanitation, circulation, fire safety, and accessibility for different types of buildings. Proper planning helps in efficient space utilization, improved movement within the building, and compliance with building regulations. This experiment focuses on studying the planning requirements and functional design aspects of buildings based on NBC provisions and applying them in building layout development. What are the important NBC provisions considered during building planning?

1. How do ventilation and lighting requirements influence building layout?
2. Why is functional zoning important in building planning?

Try: Develop a modified residential building layout by incorporating sustainable planning features such as natural ventilation, rainwater harvesting, and solar orientation while complying with NBC provisions.

1. Prepare an alternative building layout suitable for compact urban plots with limited open space.
2. Modify the building planning by introducing barrier-free access features for differently abled users.
3. Create a planning layout for a mixed-use building combining residential and commercial spaces while maintaining proper circulation and safety requirements.

2. BRICK BONDS – ENGLISH BOND & FLEMISH BOND (ODD AND EVEN COURSES)

Brick bonds are arrangements of bricks in masonry construction used to provide strength, stability, and proper load distribution in walls. English bond consists of alternate courses of headers and stretchers, while Flemish bond consists of alternate headers and stretchers in the same course. Proper bonding prevents continuous vertical joints and improves the structural performance of masonry walls. Understanding odd and even courses is important for maintaining continuity and interlocking between brick layers. This experiment focuses on drafting the plan and elevation of English and Flemish bonds for odd and even courses using standard brick dimensions and masonry conventions. The brick bond drawings are shown in Fig. 2.1.

1. What are the differences between English bond and Flemish bond in masonry construction?
2. Why are odd and even courses important in brick bonding arrangements?
3. How does proper bonding improve the strength and stability of masonry walls?

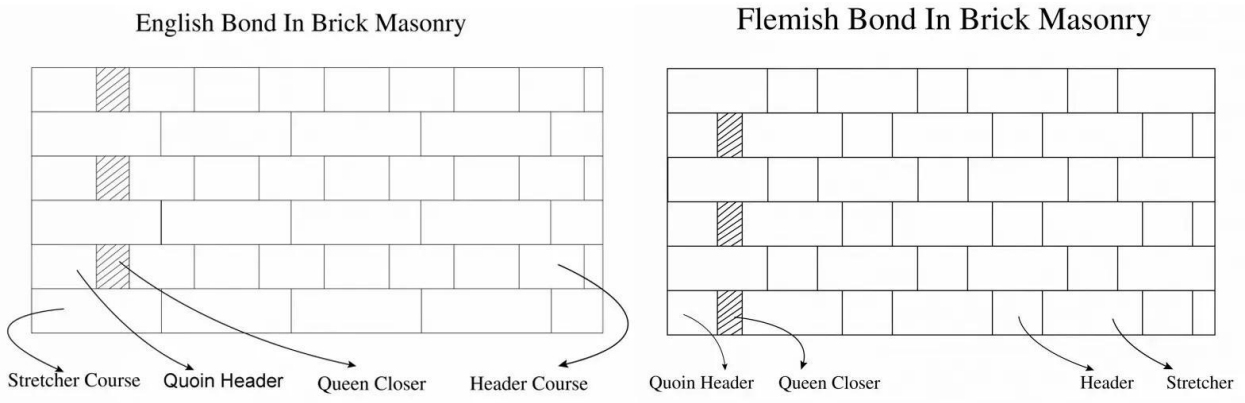

Fig. 2.1: English bond and Flemish bond for odd and even courses.

Try: Develop a modified brick bonding arrangement suitable for thicker masonry walls and corner junctions while maintaining proper interlocking and joint continuity.

1. Prepare a detailed drawing of rat-trap bond masonry for energy-efficient wall construction.
2. Modify the Flemish bond arrangement to improve the external appearance of exposed masonry walls.
3. Create a comparative brick bond layout showing material usage and joint arrangement for different wall thicknesses.

3. DEVELOPING PLAN OF SINGLE-STORIED RESIDENTIAL BUILDING

The planning of a single-storied residential building involves the systematic arrangement of spaces such as living room, bedrooms, kitchen, toilets, and circulation areas to ensure comfort, functionality, and efficient space utilization. Proper residential planning should consider ventilation, natural lighting, privacy, orientation, and accessibility while complying with standard building regulations. The layout is generally developed based on the provisions of the National Building Code of India, which specify minimum room dimensions, sanitation requirements, and planning standards. This experiment focuses on developing a floor plan of a single-storied residential building using standard dimensions and drafting conventions. The residential building plan is shown in Fig. 3.1.

1. What are the standard room dimensions and planning requirements for residential buildings?
2. How does zoning improve the functionality and circulation within a residential building?
3. Why are orientation and ventilation important in residential planning?

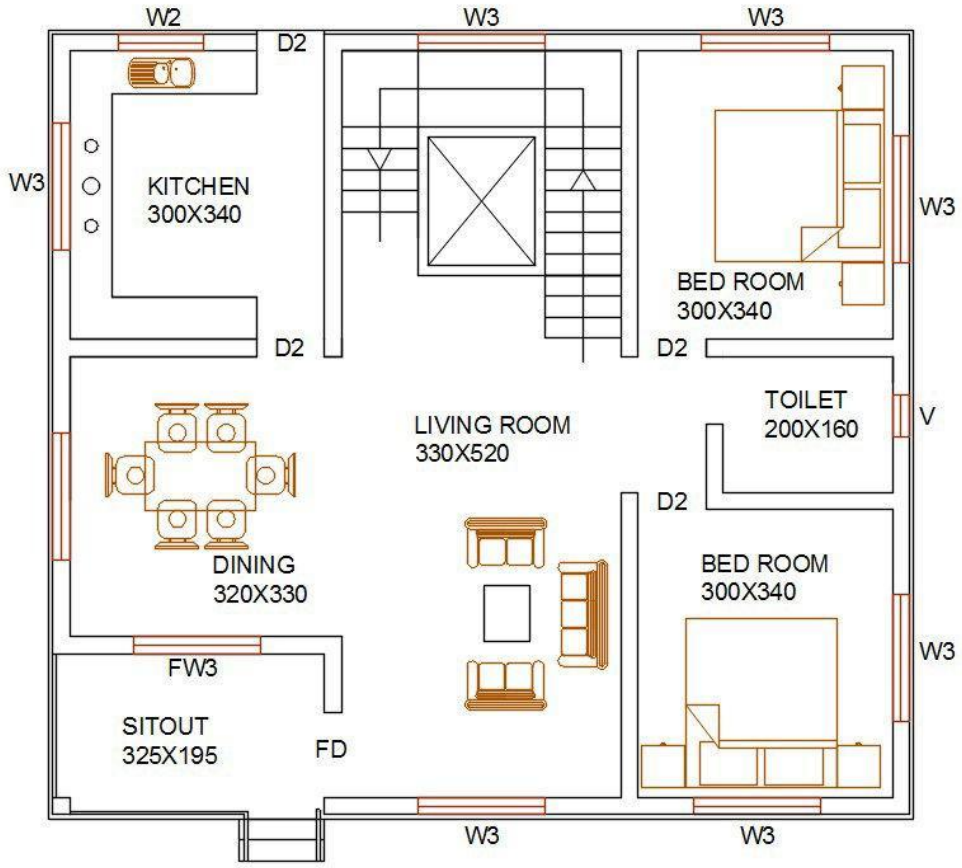

Fig. 3.1: Plan of a single-storied residential building.

Try: Develop a modified residential building plan by introducing parking space, utility area, and energy-efficient room orientation while maintaining proper circulation and ventilation.

1. Prepare an alternative residential layout suitable for a narrow urban plot with limited frontage.
2. Modify the building plan by introducing a home office or study room without affecting space utilization.
3. Create a residential floor plan suitable for future vertical expansion with provision for staircase placement.

4. DEVELOPING SECTION AND ELEVATION OF SINGLE-STORIED RESIDENTIAL BUILDING

Sectional views and elevations are important building drawings used to represent the internal and external features of a structure. The section provides details such as foundation depth, plinth level, floor height, wall thickness, lintels, roof slab, doors, and windows, while the elevation shows the external appearance and architectural features of the building. These drawings are prepared based on the floor plan developed earlier and help in understanding the vertical relationships between different building components. This experiment focuses on developing the sectional view and front elevation of a single-storied residential building using standard drafting practices and building dimensions. The sectional and elevation drawings are shown in Fig. 4.1.

1. How does a sectional view help in understanding the internal construction details of a building?

2. What building components are commonly represented in residential elevations?
3. Why are levels, heights, and wall thicknesses important in section drawings?

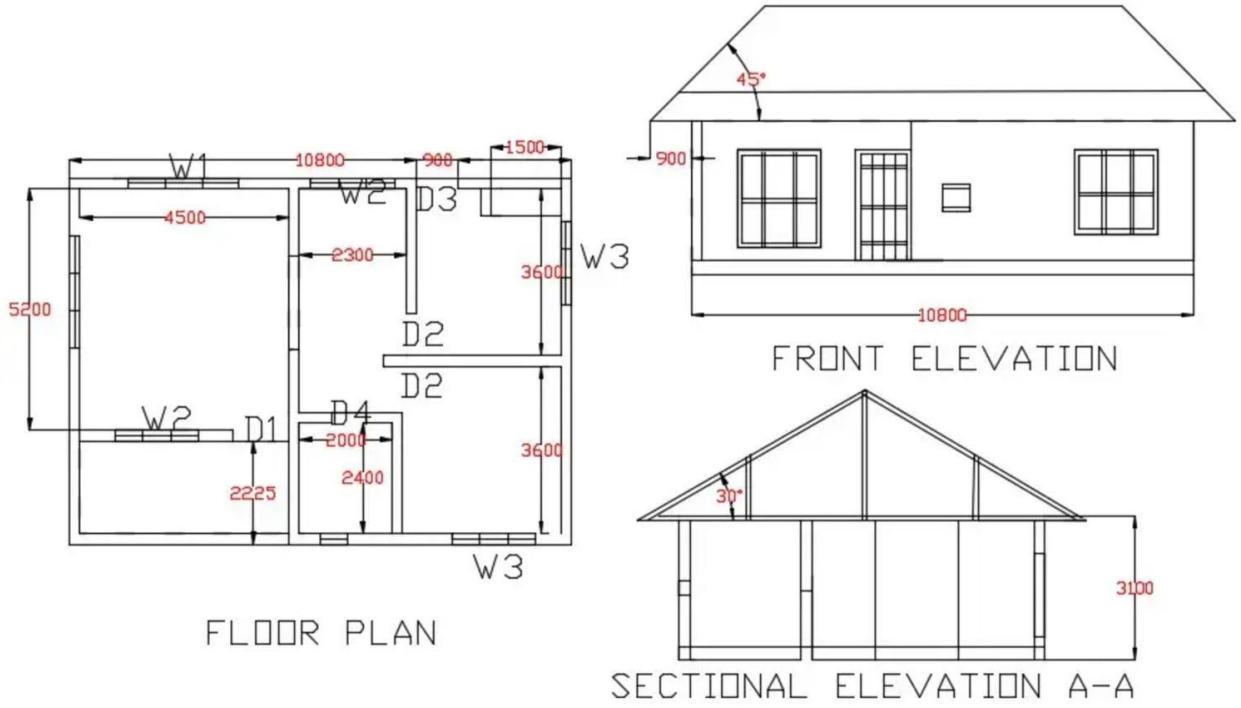

Fig. 4.1: Sectional view and front elevation of a single-storied residential building.

Try: Develop an alternative elevation and sectional view for the same residential building by modifying roof style, window positions, and floor height to improve natural lighting and ventilation.

1. Prepare a sectional view for the same building by replacing the flat roof with a sloped roof system.
2. Modify the elevation by introducing sunshades and larger window openings suitable for hot climatic conditions.
3. Create a sectional drawing showing an additional staircase provision for future vertical expansion of the building.

5. DEVELOPING PLAN OF TWO-STORIED RESIDENTIAL BUILDING AS PER BUILDING BY-LAWS

Planning of a two-storied residential building requires proper arrangement of spaces, circulation, structural components, and vertical connectivity while complying with local building by-laws. The building plan should include provisions for setbacks, floor heights, staircase placement, ventilation, lighting, and accessibility to ensure safety and functional efficiency. Proper zoning of living, sleeping, and service areas between the ground and first floors improves space utilization and user comfort. This experiment focuses on developing the plan, elevation, and section of a two-storied residential building based on standard building by-laws and drafting practices. The plan, elevation, and sectional drawings are shown in Fig. 5.1.

1. What are the important building by-laws considered during planning of multi-storied residential buildings?

2. How does vertical circulation influence the planning of two-storied buildings?
3. Why are setbacks and ventilation requirements important in residential building design?

Fig. 5.1: Plan, elevation, and section of a two-storied residential building.

Try: Develop a modified two-storied residential building plan by introducing a car parking area, balcony spaces, and rainwater harvesting provision while maintaining compliance with building by-laws.

1. Prepare an alternative staircase arrangement to improve circulation and space utilization in the building.
2. Modify the first-floor plan to include a home office or study room without affecting ventilation and lighting.
3. Create an elevation for the same building using modern façade elements and shading devices suitable for urban residential construction.

6. DEVELOPING PLAN OF PUBLIC BUILDING AS PER BUILDING BY-LAWS

Public buildings such as schools, libraries, hospitals, and office buildings require careful planning to accommodate large numbers of users while ensuring safety, accessibility, and efficient circulation. The planning of public buildings should consider functional requirements such as entrance and exit locations, corridors, staircases, service areas, ventilation, lighting, sanitation, and fire safety provisions as specified in building by-laws. Proper space organization and circulation planning help in reducing congestion and improving usability of the building. This experiment focuses on developing the plan of

a public building by incorporating standard planning principles and building by-law requirements. The public building plan is shown in Fig. 6.1.

1. What are the major planning considerations for public buildings compared to residential buildings?
2. How do circulation and accessibility influence the planning of public buildings?
3. Why are fire safety and sanitation provisions important in public building design?

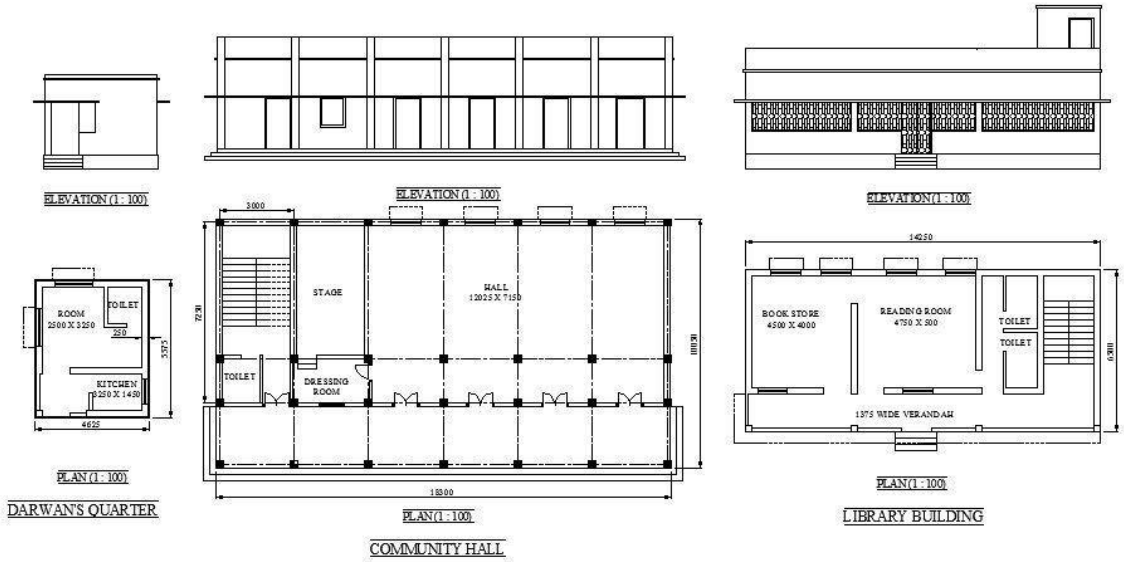

Fig. 6.1: Plan of a public building as per building by-laws.

Try: Develop a modified public building plan by introducing emergency exits, ramps for differently abled persons, and separate circulation paths for improved safety and accessibility.

1. Prepare an alternative layout by increasing occupancy capacity while maintaining proper ventilation and circulation.
2. Modify the building plan to include a solar lighting or rainwater harvesting provision for sustainable operation.
3. Create a revised public building layout suitable for disaster management or emergency evacuation conditions.

7. DEVELOPING CENTER LINE DIAGRAM OF A RESIDENTIAL BUILDING

A center line diagram is an important preliminary drawing used in building construction to represent the center positions of walls, columns, and structural components. It helps in determining the layout of the building accurately and is widely used for estimating quantities, marking foundations, and setting out construction work on site. The center line method simplifies dimensioning by indicating cumulative and overall dimensions of internal and external walls. Proper preparation of center line diagrams improves accuracy in planning and reduces errors during execution. This experiment focuses on

developing the center line diagram of a residential building using standard drafting conventions and dimensional practices. The center line layout is shown in Fig. 7.1.

1. What is the importance of center line diagrams in building construction and estimation?
2. How are cumulative dimensions represented in center line drawings?
3. Why is accuracy important while preparing center line layouts?

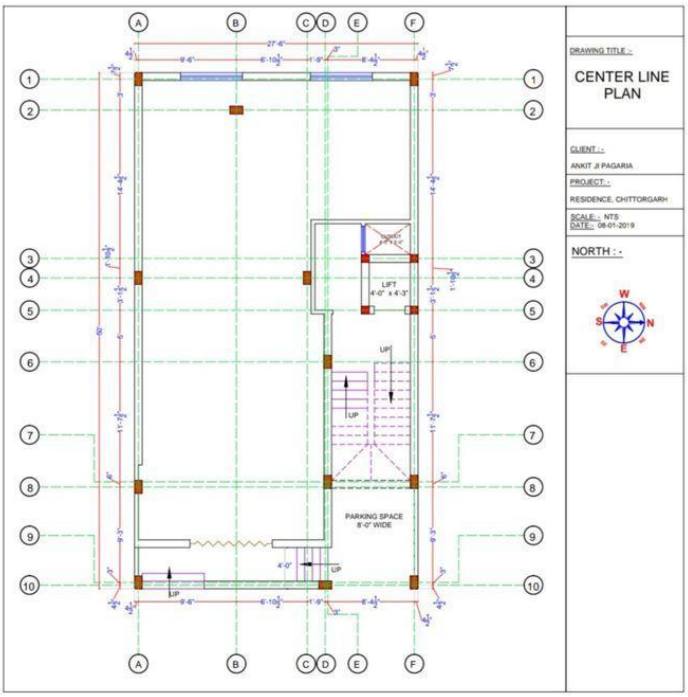

Fig. 7.1: Center line diagram of a residential building.

Try: Develop a revised center line diagram for the same residential building by introducing additional rooms and modified wall thicknesses while maintaining dimensional accuracy.

1. Prepare a center line layout suitable for a two-storied residential building with column locations included.
2. Modify the center line diagram by incorporating expansion joints for a larger building layout.
3. Create a center line plan for an irregular-shaped residential building and compare it with a regular building layout in terms of dimensioning complexity.

8. DRAFTING DETAILS OF DOOR COMPONENTS

Doors are important building components that provide access, privacy, security, and ventilation within a structure. A typical door consists of components such as frame, shutter, panels, hinges, holdfasts, and locking arrangements. Proper detailing of door components is essential to ensure accurate fabrication, installation, and functional performance. Different types of doors are selected based on location, usage,

material, and architectural requirements. This experiment focuses on drafting detailed drawings of door components including frame, shutter, panel arrangement, and joinery details using standard dimensions and drafting conventions. The detailed door component drawings are shown in Fig. 8.1.

1. What are the major components of a typical door assembly?
2. How do door materials and types influence building functionality and aesthetics?
3. Why are detailed joinery and sectional drawings important in door drafting?

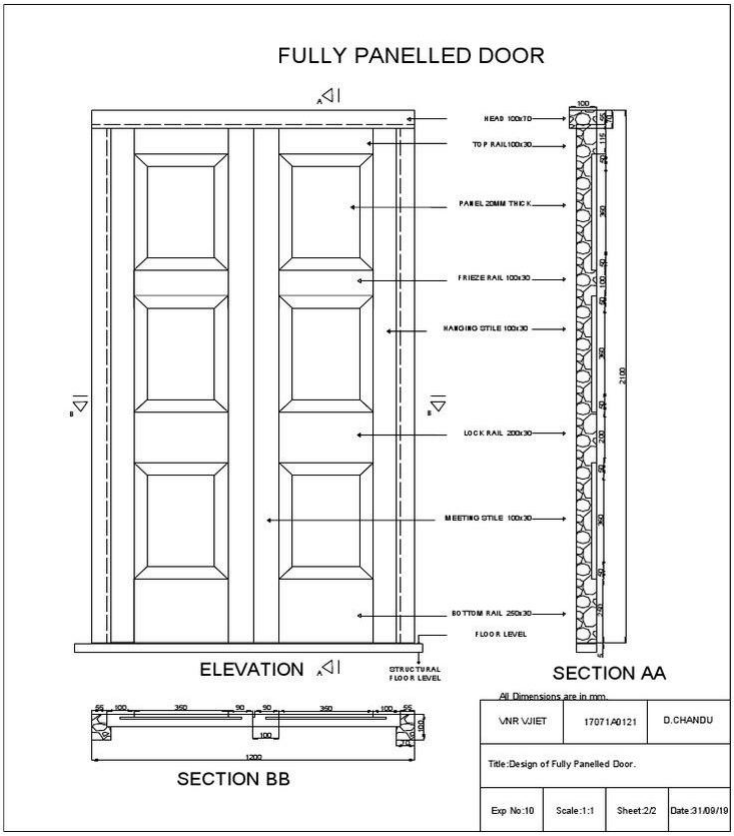

Fig. 8.1: Detailed drawing of door components.

Try: Develop a modified door detail suitable for energy-efficient and sound-insulated residential buildings by changing material type and shutter arrangement.

1. Prepare a detailed drawing of a sliding door system for compact residential spaces.
2. Modify the door design by introducing glass panels and ventilation louvers for improved lighting and airflow.
3. Create a door detail suitable for differently abled access by modifying width, threshold, and handle arrangement.

9. DRAFTING DETAILS OF WINDOW COMPONENTS

Windows are essential building components that provide natural lighting, ventilation, visibility, and aesthetic appearance to buildings. A typical window consists of components such as frame, shutter, glazing panels, hinges, holdfasts, and ventilators. Proper detailing of window components is necessary

to ensure effective airflow, weather protection, and ease of operation. Different types of windows such as casement, sliding, fixed, and louvered windows are selected based on functional and architectural requirements. This experiment focuses on drafting detailed drawings of window components including frame, shutter sections, glazing arrangements, and opening details using standard drafting conventions and dimensions. The detailed window component drawings are shown in Fig. 9.1.

1. What are the important components of a typical window assembly?
2. How do different window types influence ventilation and lighting in buildings?
3. Why are sectional details important while drafting window components?

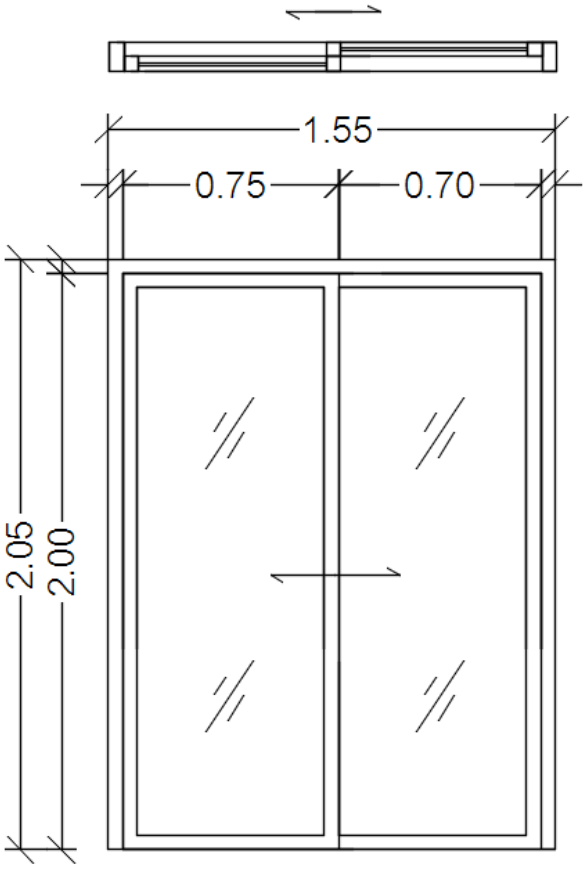

Fig. 9.1: Detailed drawing of window components.

Try: Develop a modified window detail suitable for hot climatic conditions by introducing shading devices and ventilation improvements.

1. Prepare a detailed drawing of a sliding window system for modern residential buildings.
2. Modify the window design by incorporating double-glazed panels for thermal and sound insulation.
3. Create a window detail suitable for public buildings by increasing opening size and improving natural lighting provisions.

10. DRAFTING ROOF TRUSS DETAILS

Roof trusses are structural frameworks used to support roof coverings and transfer loads safely to walls or columns. Trusses are commonly made of steel or timber and consist of components such as rafters, tie members, struts, purlins, and joints arranged in triangular configurations for stability and strength. Proper detailing of roof trusses is important for understanding load transfer mechanisms, support conditions, spacing, and connection details. Different truss forms are selected depending on span length, roofing material, and functional requirements of the building. This experiment focuses on drafting the plan and sectional details of a typical roof truss using standard drafting conventions and dimensions. The roof truss details are shown in Fig. 10.1.

1. What are the major structural components of a roof truss system?
2. How does truss geometry influence load distribution and structural stability?
3. Why are joint and support details important in roof truss drawings?

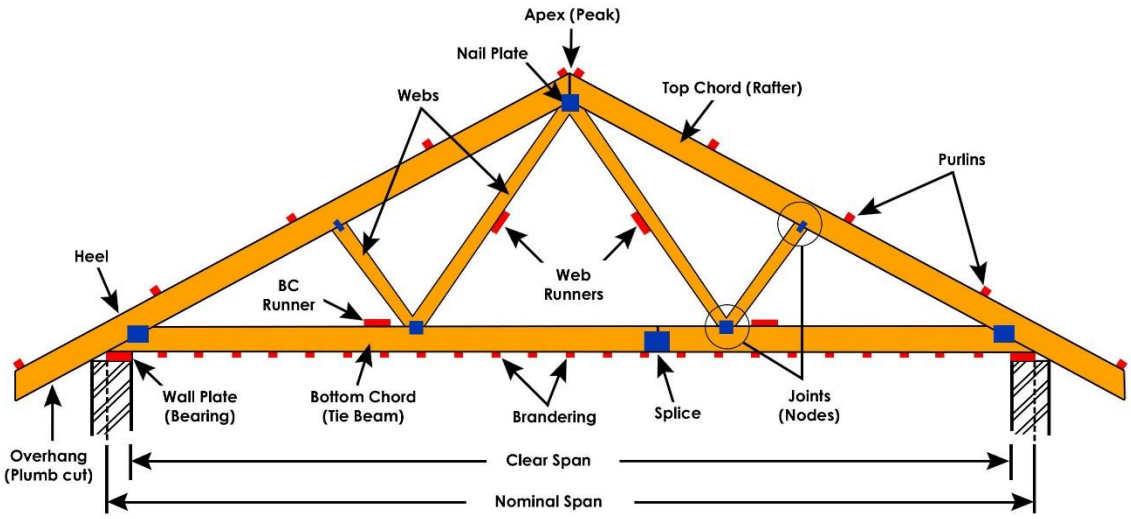

Fig. 10.1: Plan and sectional details of a roof truss.

Try: Develop a modified roof truss detail suitable for large-span industrial buildings by changing truss configuration and support arrangement.

1. Prepare a roof truss drawing for a sloped roofing system designed for heavy rainfall regions.
2. Modify the truss detail by incorporating solar panel support arrangements on the roof surface.
3. Create a lightweight roof truss design suitable for economical residential construction using alternative materials.

11. DRAFTING DETAILS OF FOUNDATION FOOTINGS

Foundation footings are structural elements used to transfer building loads safely to the supporting soil. Different types of footings such as isolated, combined, and strip footings are adopted depending on soil conditions, column arrangement, and load requirements. Proper detailing of foundation footings is important for understanding load distribution, footing dimensions, reinforcement arrangement, and

foundation depth. Footing drawings generally include plan and sectional views showing column position, concrete bed, reinforcement details, and soil level. This experiment focuses on drafting the plan and section of foundation footings using standard drafting practices and dimensions. The footing details are shown in Fig. 11.1.

1. What are the different types of foundation footings used in building construction?
2. How do soil conditions influence the selection and dimensions of footings?
3. Why are sectional details important in footing drawings?

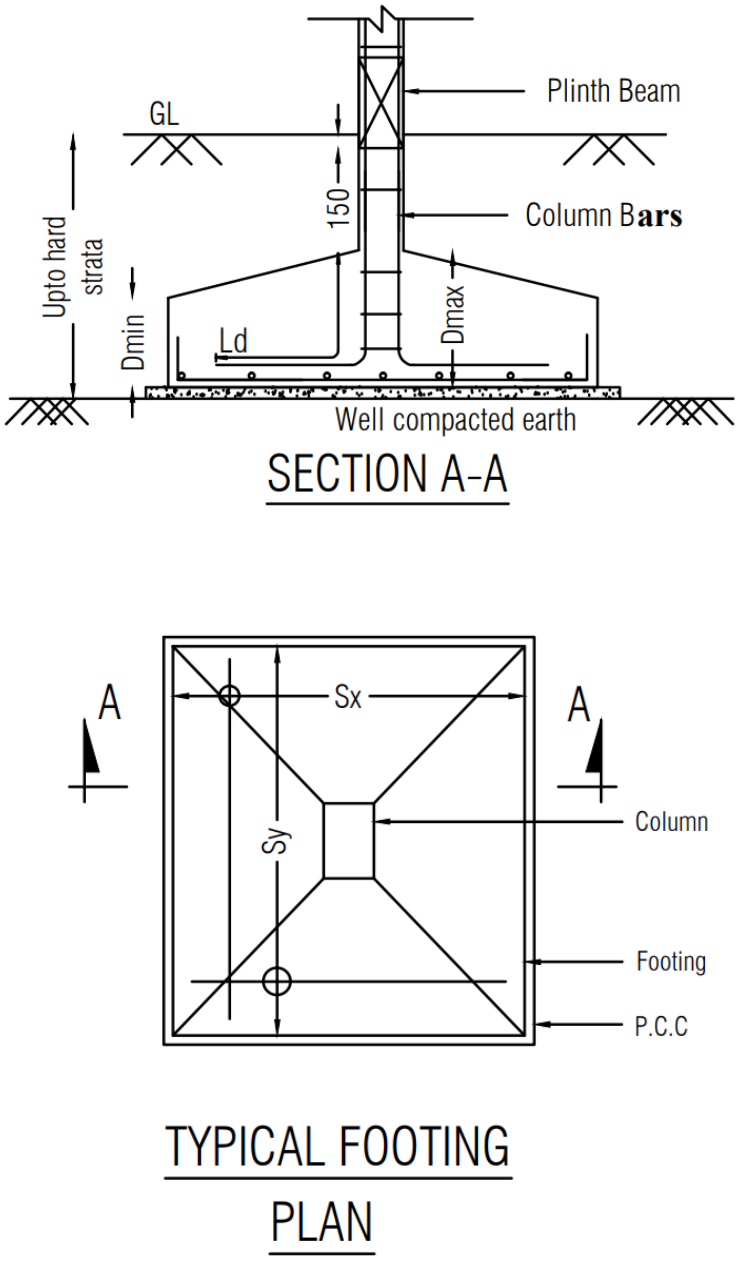

Fig. 11.1: Plan and sectional details of foundation footings.

12. DEVELOPING PLAN AND SECTION OF DOG-LEGGED STAIRCASE

A dog-legged staircase is a commonly used staircase arrangement in residential and public buildings where two flights run in opposite directions with an intermediate landing between them. This type of staircase is economical in space utilization and provides convenient vertical circulation between floors. The staircase drawing includes components such as tread, riser, landing, waist slab, handrail, and headroom, which are represented in both plan and sectional views. Proper detailing of stair dimensions and slope is important to ensure user comfort and safety. This experiment focuses on developing the plan and sectional elevation of a dog-legged staircase using standard building dimensions and drafting conventions. The staircase drawings are shown in Fig. 12.1.

1. What are the major components represented in staircase plan and section drawings?
2. How do tread and riser dimensions influence user comfort and safety?
3. Why is headroom provision important in staircase design?

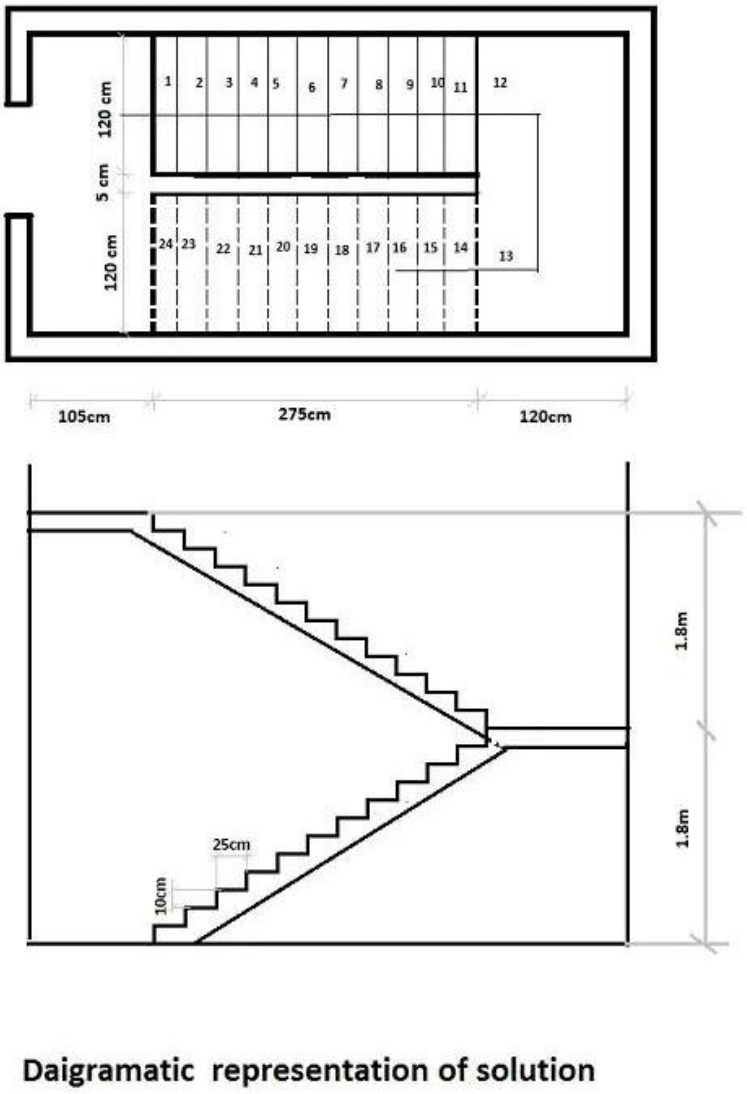

Fig. 12.1: Plan and sectional view of a dog-legged staircase.

Try: Develop a modified dog-legged staircase design suitable for public buildings by improving accessibility, circulation width, and safety features.

1. Prepare a staircase drawing with an additional handrail and ramp provision for differently abled users.
2. Modify the staircase layout to reduce space consumption in compact residential buildings.
3. Create a staircase section suitable for a multi-storied building with increased floor height and occupancy load.

13. DEVELOPING SITE PLAN WITH PLOT BOUNDARY, SETBACKS, AND ORIENTATION

A site plan is an important drawing that represents the arrangement of a building within a plot along with surrounding features and statutory requirements. It includes details such as plot boundary, building footprint, setbacks, access road, pathways, north direction, open spaces, and utility locations. Proper site planning ensures compliance with building by-laws, efficient land utilization, accessibility, and environmental considerations such as lighting and ventilation. Orientation of the building with respect to road direction, sun path, and wind movement plays an important role in improving functional efficiency and occupant comfort. This experiment focuses on developing a site plan showing plot boundary, setbacks, orientation, and access details using standard drafting practices. The site plan drawing is shown in Fig. 13.1.

1. What are the important components represented in a site plan drawing?
2. How do setbacks influence building planning and safety requirements?
3. Why is orientation important in site planning and building placement?

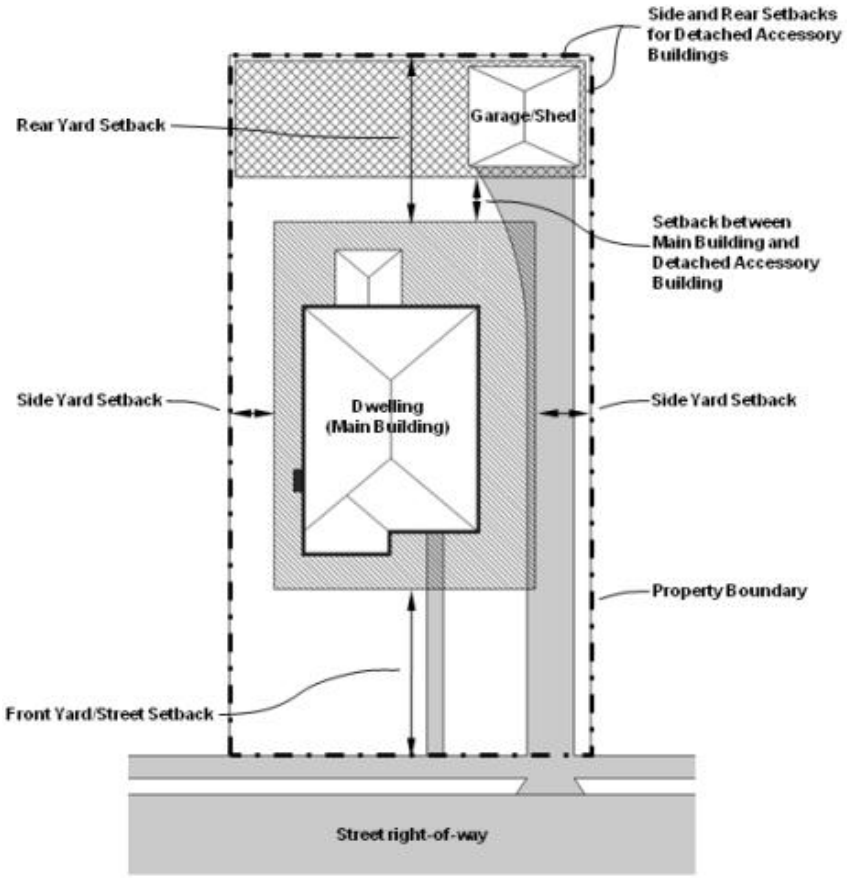

Fig. 13.1: Site plan showing plot boundary, setbacks, and orientation.

Try: Develop a modified site plan by incorporating parking layout, landscape features, and rainwater harvesting provisions while maintaining setback regulations.

1. Prepare a site plan suitable for a corner plot with roads on two sides.
2. Modify the building orientation to improve natural lighting and ventilation based on climatic conditions.
3. Create a site layout for a public building with separate entry and exit circulation arrangements.

14. DEVELOPING WORKING DRAWINGS WITH DIMENSIONS, ANNOTATIONS, AND TITLE BLOCK

Working drawings are detailed technical drawings used for the execution of building construction work. These drawings provide complete information regarding dimensions, room labels, levels, symbols, annotations, schedules, and construction details required at the site. Proper dimensioning and annotation improve clarity and reduce errors during construction, while title blocks provide important project information such as drawing title, scale, date, and drafter details. Standard drafting conventions, symbols, and layout arrangements are followed to ensure readability and professional presentation of drawings. This experiment focuses on preparing complete working drawings with dimensions, annotations, north direction, title block, and layout arrangement suitable for plotting and construction purposes. The working drawing layout is shown in Fig. 14.1.

1. What are the essential components included in a working drawing?

2. How do dimensions and annotations improve the clarity of construction drawings?

3. Why is a title block important in engineering and architectural drawings?

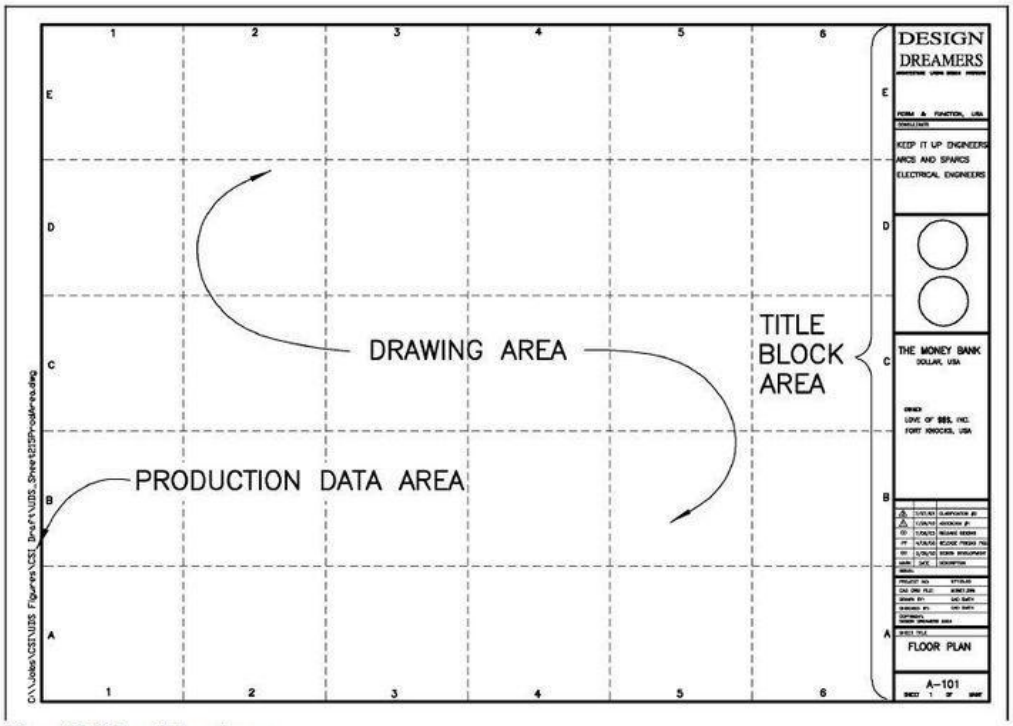

Figure 02.1 Overall sheet layout.

Fig. 14.1: Working drawing with dimensions, annotations, and title block.

Try: Develop a revised working drawing layout suitable for municipal approval submission by incorporating drawing schedules, revision tables, and additional construction notes.

1. Prepare a working drawing sheet with separate layouts for architectural and structural details.

2. Modify the drawing presentation by introducing color-coded layers and plotting standards for better readability.

3. Create a complete working drawing set for a small residential building including plan, elevation, section, and site layout in a single sheet arrangement.

V. TEXTBOOKS:

1. N.D. Bhatt, "*Engineering Drawing*", Charotar Publishing House PVT Ltd, 15th Edition 2011.
2. Rangwala, S. C. "*Civil Engineering Drawing"*, Charotar Publishing House, 2nd Edition, 2019.

VI. REFERENCE BOOKS:

1. Emmons, Paul, "*Drawing Imagining Building: Embodiment in Architectural Design Practices"*. Routledge, 2019.
2. Edwards, Brian. "*Understanding architecture through drawing",* Taylor & Francis, 2008.

VII. ELECTRONICS RESOURCES:

1. https://www.cphbooks.in/product/building-planning-and-drawing-by-dr-n-kumara-swamy-a-kameswara-rao/
2. https://nptel.ac.in/courses/112103019
3. https://nptel.ac.in/courses/112103019

VIII. MATERIAL ONLINE:

1. Course outline description
2. Laboratory manual