FLS 111 PRINCIPLES OF LANDSCAPE ARCHITECTURE (1+1)

Practical Manual

cum Record

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1ST Year 1ST Semester

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BERMIOK -737134, SIKKIM

Pub. No.: COH/SK/FLS-111/1

Citation: *Practical manual on 'Principles of Landscape architecture'*

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Designing and processing by:

PME Cell
College of Horticulture, Central Agricultural University, Bermiok, South Sikkim-737-134

Published by:

Dean, College of Horticulture, Central Agricultural University, Bermiok, South Sikkim-737-134

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FOREWORD

It is encouraging to note that College of Horticulture, Central Agricultural University, Bermiok, Sikkim has prepared **"A Manual on Principles of Landscape Architecture"** for the benefit of students, teachers, landscape owners and lovers. The importance of landscaping is now realized by everyone in the world as the gardens serve the purpose of recreation by refreshing the body and the mind and virtually they act as a cushion to straining mind from several kinds of life's stresses. Landscaping is done with a view to create a natural scene by planting of lawn, trees and shrubs. It is the imitation of nature in the garden which improves the total living environment of the people. Our mother earth planet is sketched by different types of landscaping depending upon prevailing geographical and agroclimatic conditions in form of mountains, hills, glens, valleys, seas, rivers, forests, plains, deserts, lakes, swamps, streams etc. comprising major part of natural landscape and in fact man has copied the several natural elements for improving landscape around him and converted certain areas in the form of garden for his intrinsic pleasure.

This manual brings the basic concepts of landscape design useful to students, researchers and common people and makes available easily implementable methodologies. I congratulate the authors in bringing out such valuable publication.

Anupam Mishra

PREFACE

Landscape gardening is an aesthetic branch of Horticulture which deals with planting of ornamental plants in such a way that it creates a picturesque effect. It is a very fascinating and interesting subject. The role of landscaping is multifaceted. It can enhance the beauty and appeal of a property. By selecting and arranging plants and other elements a landscaper can create a visually striking a harmonious space that complements the architecture of the building and its surroundings.

This practical manual aims at to provide comprehensive practical skill to execute the theoretical classroom knowledge. Sound practical skill is utmost required in Agri-allied fields as the Agri./ Hort. degree programme have to deal with farming community once they are off-campus and they should not face any problems. Therefore, it is very much vital that the students are well acquainted with practical know-how in addition to the theoretical learning in the classroom and library.

Keeping the aforesaid points in view, this practical manual on the course "Principles of landscape architecture" -FLS 111 (1+1) provides information on different aspects of landscaping *viz*. designing and layout of gardens, different styles of garden, types of garden with important features, use of graphic language and designing gardens using auto-cad/archi-cad. Education visit to institutional, public and botanical garden. This practical manual book will help to learn better through practical/ exercise and enrich their knowledge about the course. The faculties in the Department of Floriculture and Landscaping, COH, & MTTC & VTC, COH Bermiok of Central Agriculture University (Imphal) have made an earnest effort in compiling the manual as per the syllabus of the ICAR's 5th Dean's Committee. The manual content some illustrative exercises and questions for better understanding/ practiced on the subject.

It is hoped that this manual will serve as a useful document for the students.

Dipika Sarmah

S. Vinodh

CONTENTS

Practical No.1

Title of the exercise: Study of different types of garden equipment

objective

- To know about different kind of tools
- Their specific utility

Introduction

For carrying out day-to-day routine cultural operations in the nursery, various tools, implements and accessories are required. Some tools are simple and are used for simple operations, whereas for carrying out specific operations, special types of equipments are required. These are listed and briefly described here under:

Tools for land preparation and other basic works

Sowing and planting tools

Garden fork: Garden fork is used for breaking of soil clods and separation of medium size soil during preparation of nursery bed or fields.

Weeding fork: It loosens the soil and helps in weeding also. It consists of a long handle with a blade of handle teeth. It is drawn manually with the help of handle to collect the weeds and cops of plants etc.

Crow bar: It is an iron rod with one end pointed and other as a wedge shaped. It is used for digging out large or hand boulders from the soil and digging of pits. It is also used for breaking hard soil pan.

Shovel: It has iron blade of spoon shape and wooden handle and is used for within field transport of dug out soil required for leveling of field for preparation of nursery beds. **Pick-Axe**: It is made of carbon steel. Pick axe has two edges with provision of axial hole for attachment with handle. One edge of pick –axe is pointed and another is broadened. Pick axe is used for digging hard, compact and stony soils

Spade: It is used for lifting and turning the soil. Also used for digging the pit, preparing channel for irrigation and drainage lines.

Hoe-cum-Rake: It is of rectangular shape metal blade with fork like fore edge. It is used for digging, hoeing, earthing, leveling and collecting weeds.

Furrow opener: It is used for opening narrow and shallow furrow after sowing seeds in nursery.

Hand leveler: It consists of narrow rectangular metal blade attached to long wooden handle.

Trowel (Khurpi): It is of shovel shape but small in size with iron blade and wooden handle.

It can be made in many shapes as per local designs and requirements. It is used for hoeing, weeding and nursery plants and also for transplanting seedlings.

Axe: Iron blade, fastened to wooden handle. It is used for felling trees and cutting branches.

Bill Hook (Darat): It is made of iron curved at the far end or used for cutting hardy branches of plant and other woody shrubs in the field.

Sickle: It is used for cutting grass and leafy vegetables.

Wheel-Barrow: It is manually operated small trolly, used for carrying nursery plants, compost, fertilizes, leaf litter, horticultural produce, stones etc. from one place to another place. It can be designed into different shapes according to requirement.

Cultivator: It is a tractor drawn implement used for tilling the soil efficiently. It has tynes of quality carbon comprising of different sizes depending upon the plough depth. These days, hand driven small cultivator is more popular. It can plough upto ½ to 1 feet depth.

Disc harrow: It is used for pulverizing the soil. It is also used for turning crop residues, weeds and other debris in the soil. It is used for deep ploughing and turning of soil.

Grafting and budding tools

Knife: Knives having combined blade for grafting and budding purposes. A grafting/budding knife has a straight 7.5cm long blade and strong long handle. It has a spatula at the end of a handle, which is used for lifting the bark during budding operation. Sometimes knife has two parallel double blades, used specially for lifting or removing the patch of a bud from the budwood. Generally these knives have either a folding or fixed blade. The blade of knife should be made from high carbon steel and should always be very sharp.

Secateurs: Secateurs are considered as the most important tool for a propagator or a nurseryman. It is used for removing scions, lopping off the rootstock, preparation of scion sticks, removal of undesirable shoots/sprouts from the stock and training and pruning operations. The blades of secateurs should be of high quality carbon blade for giving smooth cuts to the stock and scions.

Grafting machines: Many machines have been developed and commercially used for the preparation of scion sticks and bud wood for budding and grafting operation in many developed countries. However, these machines are not very common in India.

Pruning saw: Several types of saws are required for performing different operations involved in propagation of horticultural plants. The commonly used are crescent saws, tapered saws and straight saws. All of them have long and widely set teeth to facilitate

pruning or cutting of green wood. Its blades should be narrow so that it can pass through the narrow or closely spaced branches.

Ladders: In propagation work, ladder is required for operations like cutting of bud wood, training of vigorous plants, performing layering operations and top working of declining plants. In general, step ladder or straight ladder or hook ladders are used for such operations in the field of propagation.

Garden Equipments

Lawn mower: A lawn mower is a machine that uses one or more revolving blades to cut a lawn to an even height. The blades may be powered either by hand; pushing the mower forward to operate the mechanical blade (s) or may have an electric motor or an internal combustion engine to spin their blades. Some mowers also include other abilities, like mulching or collecting their clippings.

Garden shear: These are mainly used for trimming hedge, clipping topiary and cutting back herbaceous plant. Most of the garden shears have 20-30m cm long straight blades.

Grass shear: This is very useful for trimming grasses from the corners, edge and other place of lawn where the lawn mower does not have an easy access. It consists long handle and blades are set at right angles to the handle parallel to the ground.

Tying and wrapping Materials:

Tying materials: It is essential to hold scion and stock firmly together to have successful graft/bud union. For this purpose a suitable tying or wrapping material is required. Generally polyethylene tapes/strips, waxed string and cloth, raffia fibro and rubber strips are used for this purpose. In addition, adhesive tapes similar to surgical adhesive tapes but lighter in weight are also used by commercial nursery men.

Grafting wax: Wax is used by propagator to seal the graft union for preventing moisture loss and desiccation of cells at cut surface and to prevent the decay of wood by way of checking the entry of pathogens. Waxes are of two types i) Hot wax ii) Cold wax.

Labels: Labels are used for proper labeling of plants, before sale. Labels may be made of paper, card board, wooden, celluloid, aluminum and plastic etc.

Pots: Pots of different shapes and sizes are used in nursery. They may be of clay, metal or plastic usually 10cm, 15cm or 20cm for single specimen. Pots are of different types, tube pots, ¼ size,1/2 size,3/4 size and full size, thali and urn. These are used for potting ornamental plants, fruit plants, saplings etc. Iron pots/ plastic pots are used for irrigation purpose also.

Spray-pumps: To spray protective material i.e. insecticides/pesticides/fungicides to eliminate the infection of pathogens or insects, spray pumps are very important tools. Pumps are of different shapes, size and types. Commonly used sprays are knap-sack sprayer, rocker sprayer, foot sprayer, hand sprayers or power sprayers. Depending upon the volume of nursery and specific purpose different types of sprayers are put in operation.

Chain saw: It operates using fuel (petrol/kerosene). It aid to cut wood logs of bigger size and lopping of branches and shoots.

Chain weeder: It is operated by petrol/diesel/kerosene. It is used to slash the weeds on large scale.

Rose can: A tubular pipe with rose i.e. fitted into the can through which water is sprinkled over the nursery beds until the germination of seeds and to avoid splashing of seeds from the nursery beds due to loose pipe irrigation and flood irrigation.

Iron pan: It is made of iron and used for transporting pot mixtures, potted plants through head load from one place to another for short distance.

Hose pipe: This is available in convenient length. Irrigation to nursery plants is made possible to any extent.

Pruning shear: It is made of iron fitted with wooden handle. It is used to prune unwanted branches, collection of scion, trimming of the edges and hedges and topiary work.

Scythe: It is long knifed, fitted with wooden handle. It is used for slashing of weeds.

Exercise:

1. Draw the different garden equipment.

Practical No.2

Title of the exercise: Use of drawing equipments, graphic symbols and notations in landscaping

A beautiful garden takes time, effort, money and maintenance. Starting with a good garden plan can help cut down on all of those things.

Steps in landscape planning and design

Drawing a base plan*:*

It is a drawing of the site or house or lot which is to be designed for gardening. This gives a view of the site from above looking down. It should include the correct dimensions of the plot and also physical features, if any existing along with their exact location. Landscape design plans may be drawn by hand using inexpensive drafting equipment or by using sophisticated computer technology, computer aided designs (CAD).

Site analysis*:*

A designer has to visit and study the landscape site. Visits at different times of the day and under different weather conditions are helpful. Based on the observations recorded during the site visits, prepare a site analysis plan and trace the base plan through this. The site analysis plan then can be referred to throughout the design process. Various features to be noted in site analysis plan are as follows.

Orientation of the site - Orientation of the plot with reference to north direction along with accurate dimensions.

Layout of the land - Lay of the land in terms of undulations (topography), surveyor's use contour lines to represent the vertical rise or fall of the land. Each contour line connects all of the points of equal elevation. Grade of the land should be studied and drainage pattern determined. One goal of landscaping is to limit changes to natural land form and slope of the site so that the new landscape remains consistent with the surrounding properties.

Soil characters - The soil found on the landscape site provides plants with water, air, nutrients and support. Soil texture and structure influence the availability of water, air and nutrients to the plants. It is a good idea to have soil tested and soil profile done.

Existing Vegetation: Inspect existing plants to determine their value, correct identification will reveal the potential size of the plant, health problems and other attributes.

Natural features - Rocks, earth and water found on the site are considered natural features. While conducting the site analysis, determine which natural features have value and are to be preserved.

Climate - Climate greatly influences the landscape design and plant selection. The various components of climate include temperature, precipitation, humidity and wind. Research on the

macro climate is extremely helpful in landscape design process. The micro-climate is influenced by buildings, plants and landscape structures.

Establishing physical features:

The design step that follows goose egg planning is the establishment of bed patterns. A bed pattern is a border that outlines where plants are planted. Bed patterns a re influenced by lines of force. These lines have visual energy and extend into the landscape. The areas having paths, walks, drives, beds, decks, patios, lawn, should be demarcated. Once these areas are marked remaining work like laying out a lawn, cementing the paths and planting the vegetation can be proceeded further. Many famous formal gardens benefit from the symmetrical look provided by 90° bed pattern. Symmetrical landscapes have the same bed patterns and plants on each side of the axis.

Drawing goose egg plan:

It is important to understand that various activities are best located in different areas of the landscape. A good way to organize activity areas is to quickly draw small sketches and dimensions on the base plan. Sketch rough ovals and circles on the small drawings to represent activities. These odd shapes are sometimes referred to as goose egg plan or functional diagram. Some examples of activities include play area, lawn area, plantings, screen, water garden, etc. Label the different goose egg shapes as to the activity intended. Try to be open minded when working on the goose egg plan. Consider a wide range of possible solutions. After several sketches are made look at the plans carefully and choose the plan that is most practical.

Locate trees on the plan:

Trees are the largest element of the landscape, locate them on the plan once the bed patterns have been established. Trees play many roles in the landscape. These are perennials life cycle ranging from 10 to 100 years depending upon the species, hence care should be taken while selecting the tree species. Selection of the species for a particular location should be done after proper visualization. Trees can be planted for various purposes like shade, shelter, protection, ornamental purpose, etc. They are planted along approach roads, avenues, borders, etc. They may be planted individually or in groups either in straight rows or otherwise depending upon the garden design. While planting in the groups, harmonizing of colour and form, texture and time of flowering are essential considerations. It is useful to have trees which will flower during different seasons. This will ensure colour almost through out the year.

Draw shrubs within planting beds by size and function:

Shrubs have multiple functions in the landscape. They can be used as specimen plants, group plantings, hedges, screens, foundation plants, or shrub borders. Consider their foliage,

flowers, branching habits, size, shape and suitability to the growing conditions. Draw the shrubs at their mature size in the planting bed. Locate plants in the planting bed by placing the larger shrub towards the back of the bed. The smallest plant material should be to the front of the planting. Shrubs are needed for space, division at a lower level. If a shrub is to be planted in a lawn care must be taken to maintain the unity of the landscape. Shrubs planted along the sides of a lawn also appear attractive.

Locate other perennials and ground cover:

Ground cover refers to a woody or herbaceous plant that forms a covering on the ground. Most ground covers have a maximum height of 12 inches. Landscapers also recommend ground covers under trees or shady areas where grass would not grow. Since groundcover plants do not have individual form, their design form is determined by the shape of the landscape bed. Ground covers are used instead of grass to cover the soil. Ground covers improve the appearance on the ground, hold the soil, and prevent erosion on steep slopes. Spacing of the plants will determine how quickly or slowly the ground will be covered. Most ground covers are perennial plants that grow year after year without replanting. Some grounds covers have showy flowers and while others have interesting leaf patterns.

Assign desired textures and colours to the trees, shrubs, perennials and ground cover:

Texture is another design quality of plants to consider. Texture is the appearance of plants in terms of coarseness or fineness, roughness or smoothness, heaviness or light ness, denseness or thickness. Coarse textured plants appear closer to the viewer than they really are, while fine textured plants appear more distant. Both leaves and branches determine a plant structure, coarse texture result from large leaves and twigs, dull leaf surface, short petioles and entire leaves. Smaller leaves and twigs, glossy leaf surfaces, long petioles and cut leaves contribute to the fine texture plants. There are some rules of design to be kept in mind when considering texture of a plant. Monotony results if all the plants in the landscape are similar textured. Therefore some variation should be used. Is is most pleasing to the eye, if changes in texture take place gradually. A smooth transition from fine textured plants to coarse textured plants is preferred. Once the texture of the plants is decided, determine if they are evergreen or deciduous; assign each plant or grouping a desired colour and texture.

Colur has the greatest appeal or visual impact of all the design qualities. The colours of visible light are divided into two major groups, warm colours which include yellow, orange and red; and cool colours including green, blue and violet. Plants with red green, yellow green or black green foliage have high visual energy and appear closer the viewer. Those plants with blue green or green foliage have lower visual energy and appear more distant. For variety and

interest, plants with warmer leaf colours can be used. However, warm colours such as yellow, maroon, bronze or variegated leaves easily dominate the landscape. A good rule to follow is to use at least 9 green plants for every one plant that has the visually active warm leaf colour.

Select plants based on size, texture, colour and function determined in above steps.

Landscape Planning and Construction

Landscape construction is the execution of the planting plan and installation of hard scape features. Depending upon the purpose/need, constraints and feasibility, the landscape designer through the design process develops a planting plan that shows the exact location for plant materials includes a plant materials list and also shows the location for any hardscape features. Contours and spot elevations may also be shown on the planting plan. Landscape contractors use the planting plan to install the hardscape features and plant the trees, shrubs, and flowers as designed.

Topography of the site is measured and the site is graded properly. The job of establishing physical features as designed in the plan would be given to a landscape contractor. The details of soil texture, structure, pH, drainage depth of top soil and subsoil and the nutrient status of the soil should be determined following appropriate procedures.

Establishment of the plant material

Planting plans show the plant by name and its location within the plan. Designers recommend planting balled, burlapped or container grown plants depending on time of the year and the budget for each job. A container nursery grows nursery crops to marketable size in containers. A field nursery grows nursery crops to marketable size in fields. Field nurseries make burlapped and bare root plant material available. Evergreen shrubs best survive transplanting in the landscape if grown as burlapped or container grown material. The factors to be considered when installing plants include water requirement, growth rate, hardiness, nutrient and pH needs. Water requirement refers to the amount of water plants need to live and grow. Some plants need more water than others. Increasingly, plants that need less water are preferred. Drought tolerance is the ability of a plant to live and grow with low amounts of moisture. The climate in the area being landscaped is important in plant selection plants that need an abundance of water should be used in places with high natural moisture.

Plants grow at different rates and to different sizes. Plant selection for landscapes should consider the growth rate of plants. A plant that is very small when planted may grow into a large plant at maturity. Trees and shrubs are classified by height and spread. Plants should be selected and placed in a landscape on the basis of mature height. Spread is the size and fullness of the canopy. Trees may have large canopies. The space available to achieve the purposes of the landscape must be considered. Masses of annuals with little spread may require

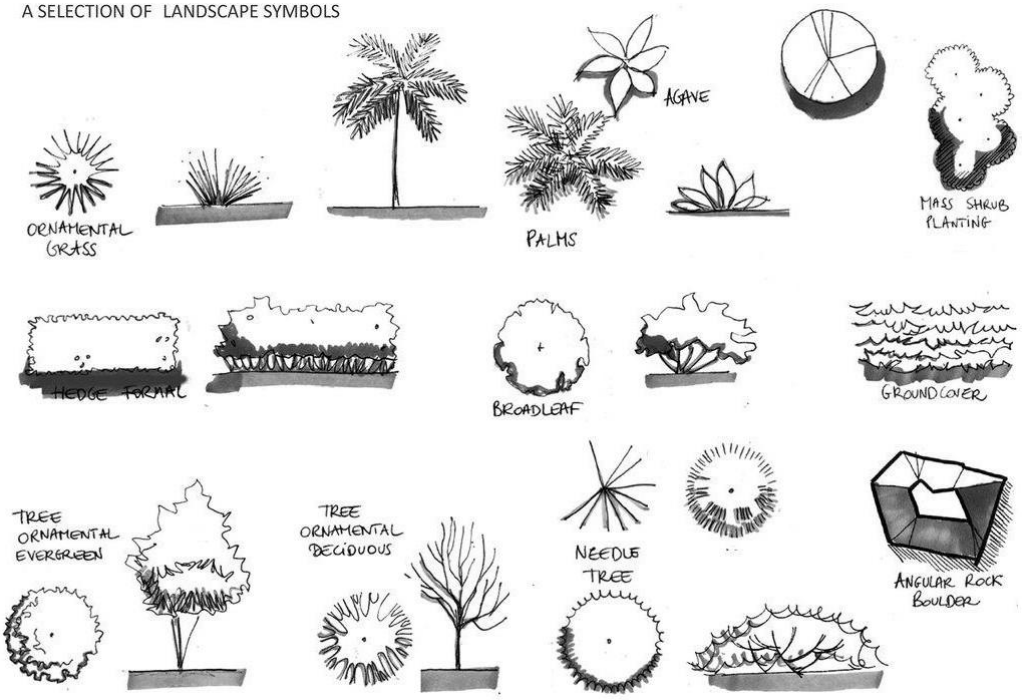
placing the plants close together. Plants vary in nutrient and pH requirements. Soil analysis determines the nutrient available in the soil. Part of preparing the site for planting includes soil tests. Matching the plants to naturally available nutrients and pH reduces the cost.

Estimates of Expenditure

Calculation of expenditure for the development of new gardens is an important aspect. It needs careful accounting of all items of work to be done and supplies required. Current and correct market rates are the basic inputs for preparation of proper estimates of expenditure. Once the designing is completed, listing of requirements can be done taking in to account details of every feature as per landscape plan.

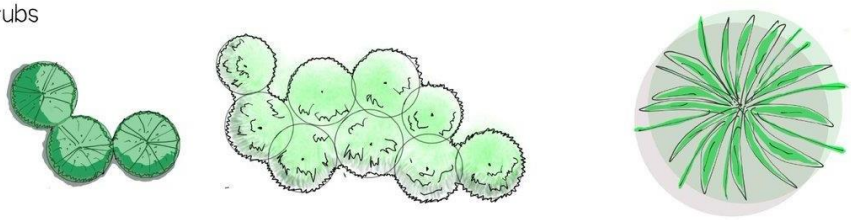
When the work is to be executed by engaging contractors or landscape developers, estimating expenditure and total cost for development of the proposed garden is a matter of mutual satisfaction between the client and contractor.

A SELECTION OF LANDSCAPE SYMBOLS



Trees

Shrubs



Grass-like Plants

Rocks

Stone Paving

Water Feature

Exercise:

1. Draw a garden layout by using different graphic symbols.

Practical No.3

Title of the exercise: Study and design of different styles of garden

Formal Gardens

- First plan is made on paper and then land is selected accordingly.
- Land is levelled
- A formal garden is laid out in a symmetrical or a geometrical pattern.
- In this garden the design is stiff as everything is done in a straight and narrow way.
- In such gardens everything is planted in straight lines.
- Also, if there is a plant on the left hand side of a straight road, a similar plant must be planted at the opposite place on the right hand side i.e., mirror image of each other.
- The flower beds, borders, and shrubbery are arranged in geometrically designed beds.
- Hedges, edges and topiary are regularly trimmed.

  Ex: Mughal, Persian, Italian and French styles of garden.

Informal gardens

- Plan is forced to fit the land
- Main aim is to capture natural scenery
- Land is not levelled
- Asymmetrical design
- Non- geometrical beds and borders
- Untrimmed hedge, edge and topiary
- Individual plants are not selected as feature

  Ex: Japanese garden, English garden

Free style garden:

- Best of both formal and informal styles are selected to secure the most picturesque effect. Eg: Zakir Hussain rose garden Chandigarh.

Wild style garden:

- No rules are followed but aim is to make the garden beautiful and natural. William Robinson invented herbaceous border and gave the concept of wild gardening

Exercise:

1. Draw different types of garden layout.

Practical No.4

Title of the exercise: Study of graphic language and designing gardens using auto-cad/archi-cad

Use of computers into the design process has benefited landscaping industry in several ways. There are several advantages in using computers for design. The most important factor is that the computer can store and handle large amount of engineering data, which can be used in various stages of design, development and manufacturer, like conceptual design, analysis, component design, documentation, process planning and manufacturing. The product development approach using the computer aided design and computer aided manufacturing (CAD/CAM) results in better and consistently good quality products invariably at a lower cost, with the attendant benefits of faster development of different variants of the product or model

Computer Aided Design

CAD technology makes use of the computer to created drawings of parts and assemblies on computer files which can be further analyzed and optimized. The functional, ergonomic and aesthetic features of the product can be evaluated on the computers. This has been made possible through the use of design workstations or CAD terminals and graphics and analytic software which help the designer to interactively model and analyze objects or components.

DRAWING COMMANDS Command: limits

Specify lower left corner or [ON/OFF] <0.0000,0.0000>:

Specify upper right corner <420.0000,297.0000>:

Command: z

ZOOM

Specify corner of window, enter a scale factor (nX or nXP), or [All/Center/Dynamic/Extents/Previous/Scale/Window] <real time>: a Regenerating model.

Command: l

LINE Specify first point: 50,50

Specify next point or [Undo]: 60,80

Specify next point or [Undo]: 90,100

Specify next point or [Close/Undo]:

Command: _mline

Current settings: Justification = Top, Scale = 20.00, Style = STANDARD Specify start point or [Justification/Scale/STyle]: 20,25

Specify next point: 80,55

Specify next point or [Undo]: 30,45

Specify next point or [Close/Undo]: 90,86

Specify next point or [Close/Undo]: 100,125

Specify next point or [Close/Undo]: 150,162

Specify next point or [Close/Undo]:

Command: _pline

Specify start point: 80,90

Current line-width is 0.0000

Specify next point or [Arc/Close/Halfwidth/Length/Undo/Width]: 78,90

Specify next point or [Arc/Close/Halfwidth/Length/Undo/Width]: a Specify endpoint of arc or [Angle/CEnter/CLose/Direction/Halfwidth/Line/Radius/Second pt/Undo/Width]: 100,150

Specify endpoint of arc or

[Angle/CEnter/CLose/Direction/Halfwidth/Line/Radius/Second pt/Undo/Width]: l

Specify next point or [Arc/Close/Halfwidth/Length/Undo/Width]: 156,135

Specify next point or [Arc/Close/Halfwidth/Length/Undo/Width]:

Command: _polygon

Enter number of sides <4>: 6

Specify center of polygon or [Edge]: 150,150

Enter an option [Inscribed in circle/Circumscribed about circle] <I>: Specify radius of circle: 98

Command: _rectangle

Specify first corner point or [Chamfer/Elevation/Fillet/Thickness/Width]: 189,200

Specify other corner point: 200,250

Command: _arc

Specify start point of arc or [CEnter]: 80,90

Specify second point of arc or [CEnter/ENd]: 90,60 Specify end point of arc: 50,45

Command: _circle

Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: 250,250 Specify radius of circle or [Diameter]: 200

Command: _ellipse

Specify axis endpoint of ellipse or [Arc/Center]: 200,200

Specify other endpoint of axis: 300,200

Specify distance to other axis or [Rotation]: 30

EDITING COMMANDS

Command: _erase

Select objects: ALL 9 found

Command: _copy

Select objects: l 1 found Specify base point or displacement, or [Multiple]: Specify second point of displacement or <use first point as displacement>:

Command: _mirror

Select objects: 1 found Specify first point of mirror line: Specify second point of mirror line: Delete source objects? [Yes/No] <N>:

Command: _offset

Specify offset distance or [Through] <1.0000>: 10

Select object to offset or <exit>: Specify point on side to offset: Select object to offset or <exit>: Specify point on side to offset: Select object to offset or <exit>:

Command: _array

Select objects: 1 found Enter the type of array [Rectangular/Polar] <R>:

Enter the number of rows (---) <1>: 4 Enter the number of columns (|||) <1> 4 Enter the distance between rows or specify unit cell (---): 20 Specify the distance between columns (|||): 20

Command: _array

Select objects: 1 found Enter the type of array [Rectangular/Polar] <R>: p Specify center point of array: Enter the number of items in the array: 8 Specify the angle to fill (+=ccw, -=cw) <360>: Rotate arrayed objects? [Yes/No] <Y>:

Command: _move

Select objects: 1 found Specify base point or displacement: Specify second point of displacement or <use first point as displacement>:

Command: m MOVE

Select objects: 1 found Specify base point or displacement: Specify second point of displacement or <use first point as displacement>:

Command: _rotate

Current positive angle in UCS: ANGDIR=counterclockwise ANGBASE=0 Select objects: 1 found Specify base point: Specify rotation angle or [Reference]: 56

Command: _scale

Select objects: 1 found Specify base point: Specify scale factor or [Reference]: 2

Command: _stretch

Select objects to stretch by crossing-window or crossing-polygon... Select objects: 1 found Specify base point or displacement: Specify second point of displacement:

Command: _lengthen

Select an object or [DElta/Percent/Total/DYnamic]: Current length: 494.4100 Select an object or [DElta/Percent/Total/DYnamic]:

Command: _trim

Current settings: Projection=UCS Edge=Extend Select cutting edges ... Select objects: 1 found Select object to trim or [Project/Edge/Undo]: Select object to trim or [Project/Edge/Undo]:

Command: _extend

Current settings: Projection=UCS Edge=Extend Select boundary edges ...

Select objects: 1 found Select object to extend or [Project/Edge/Undo]: Select object to extend or [Project/Edge/Undo]:

Command: _break

Select object: Specify second break point or [First point]:

Command: _chamfer (TRIM mode)

Current chamfer Dist1 = 10.0000, Dist2 = 10.0000 Select first line or [Polyline/Distance/Angle/Trim/Method]: Select second line:

Command: _fillet

Current settings: Mode = TRIM, Radius = 10.0000 Select first object or [Polyline/Radius/Trim]: Select second object:

Exercise:

1. Draw a garden design by using CAD

Practical No.5

Title of the exercise: Steps in designing of home garden

Landscaping as it is done for larger estates or public parks can also be implemented in a tasteful and artistic way for a small home ground, though on a smaller scale.

There are some basic guidelines for a home landscaping. Personal preference plays a considerable role in developing a home garden. The home including its surrounding should be an outward expression of the inner personality and individuality of the owner.

Basic guidelines for a home landscape

- The personal preference plays a considerable role in developing a home garden.
- The home including its surroundings should be an outward expression of the inner personality and individuality of the owner.
- It is advisable to think a lot before even a single digging work starts.

Master plan has to be prepared according to a scale (1: 15 05 1: 20) in which all the features such as house wall, drive way, paths, flower beds, shrubbery, etc., are plotted.

Making a Plan

If the garden area is sufficiently large, this can be divided into three areas.

1. **Approach or Public Area**
    - This is the area from the street side extending to the entrance of the house. The approach area should not be overcrowded with large trees. It is better to have doorway or "foundation" plantings with low growing shrubs and evergreens.
    - Big trees, if space permits, can go in the backyard but should not be overcrowded in the front. But a few low-growing trees can be accommodated at the appropriate places as next to entrance, if space is available or somewhere in the front lawn.
    - An open spacious lawn with some annuals (zinnias, salvias and petunias) or herbaceous perennials (chrysanthemum, canna and Impatiens in shade) can be planned in addition to the foundation plantings.
2. **Work or Service Area**
    - Wherever feasible this and the living area should be situated at the back of the house as these need privacy.
    - This area includes the kitchen garden, compost bin, nursery, tool shed and garage.

3. **Private Garden Area or Living Area**
    - In the western countries, this is generally termed as the outdoor living area, where people sit out in the winter to enjoy the sun or rest in the summer under an arbour or shade of tree.
    - This area should be easily approachable and visible from the living (drawing-room) or dining-room, screened from unsightly objects and for privacy. In the western countries people prefer a terrace and this is the place where it should come.
    - There should be some shaded sitting spot such as a tree or arbour with garden benches. A wide stretch of lawn with shrub border or few annuals beds or a rose garden can also be included in this section. A tennis court or a play area has to be included here, if there is enough room.
    - A doorway near the house needs special attention as this is the place which receives maximum attention from a visitor. Depending upon the approach a doorway can be planted informally, formally, or in a semi-informal pattern.

4. Many people advise not to include any pool or formal rock garden or the kind in a home garden. But there is no harm if a formal or informal lily pool can fit in with the overall design, with or without a fountain or a rock garden. A statue or sun dial can also be well fitted in some spacious compounds.
5. It can be arranged with a garden-type design consisting of an ornamental shade or flowering tree perennial and annual flowers, climbing roses, some bulbs such as Zephyranthes, Amaryllis, and daffodils (for temperate regions).
6. A bed of roses can also be a spot of beauty provided it receives the morning sun. Symmetrical plants with pyramidal form such as *Thuja occidentalis*, *Juniperus chinensis*, and *Cupressus macrocarpa* are preferred by many near the doorway for a formal treatment.

Trees suitable for Small Gardens

Bauhinias in different species are quite suitable. Bottle brush is suitable for many situations. *Tecoma argentea, Cassia fistula*, and *Cassia spectabilis*, Cherries, (*Prunus sargentii*), Weeping willow (*Salix babylonica*) and *S. purpurea var. pendula* are also very ornamental. Some shrubs *Ixora singaporensis, Mussaenda philippica, Azalea* etc.

Exercise:

1. Draw a design of garden for educational institutions.
2. Fill up the plant species suitable for educational institutions as given below-

Sl. No.	Common name	Botanical name	Family	Purpose
1.				
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Practical No.6

Title of the exercise: Study and design of educational institutions (schools,colleges etc.)

A planned and properly landscaped school and college building is a world of difference in appearance and beauty than an unplanned one. Moreover, a good garden in the campus inculcates aesthetic sense to the younger generation. The main aim of landscaping educational institutions will be to create a barrier against noise, storm and dust and to provide shade. It may also be necessary to screen some ugly places with the help of plants.

General recommendation:

1. Planting large trees along the premises and the rear and wings will help to down noise and cut down dust and storms. This plantation will also help to keep down severe heat and cold.
2. The front should be planted with medium-sized flowering trees for beauty.
3. The trees should not completely obstruct the view of the building from outside.
4. For enhancing the scenic beauty, a row of flowering trees with different blooming seasons may be planted in front of the large trees along the periphery.
5. It is difficult to give any general recommendation regarding the types of trees, as this will vary according to the architectural design, situation and climate. The object is to provide beauty and comfort depending on convenience.
6. The roads and paths are to be formally planted with medium to tall flowering plants.
7. Before planting, provision should be made for overhead wiring and sewerage so that these do not interfere with the avenue planting.
8. Where the electric wires limit the choice of avenue trees, small flowering trees such as *Cochlospermum gossypium*, *Callistemon lanceolatus*, *Bauhinia variegata*, and *Tecoma argentea* can be planted.
9. A lawn looks good in an educational institution, but is very difficult to maintain.
10. The playground can be planted with lawn, if this can be maintained or should be left bare.
11. A thickly planted belt of *Eucalyptus* for peripheral planting is considered ideal. Silver oak (*Grevillea robusta*), *Polyalthia longifolia* and *Samanea saman* are also suitable for this purpose.
12. *Cassia fistula*, *Cassia nodosa*, *Tecoma argentea*, *Erythrina indica*, *Delonix regia*, *Lagerstroemia flos-reginae* and *Bauhinia variegata* are suitable for planting in the front and in the front row of the border planting.

13. The roads and paths are to be formally planted with medium to tall flowering plants.
14. Shrubs play an important part in the institution landscaping. Border planting of shrubbery on large grounds or at the back of the school campus serves useful purpose of filling the gaps between the trees and lawns.
15. Shrub borders can replace hedges in parks or playgrounds since they are very effective and also the maintenance is minimum.
16. Climbers such as *Bignonia venusta* supported against a wall would look beautiful.
17. Creepers climbing with their rootlets such as *Ficus repens, Tecoma radicans* can also be trained over stone or brick walls.
18. Besides an ornamental or a landscape garden, universities and colleges can also maintain a botanical garden or a student garden, where the plants are arranged in groups, family wise so that such gardens become educative.

Exercise:

1. Draw a design of garden for educational institutions.

2. Fill up the plant species suitable for educational institutions as given below-

Sl. No.	**Common name**	**Botanical name**	**Family**	**Purpose**
1.				
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Practical No: 7

Title of the exercise: Study and design of public buildings

There are several buildings in towns and cities which are frequently visited by a large number of people. The government and private offices, courts, cinemas, hotel, travellers' bungalows and auditoria fall under this group.

The objectives of planting trees around public buildings are:

1. To cut down the noise
2. To reduce the dust
3. To provide shade
4. To improve microclimate

Major points to be considered for planning and design of public buildings:

1. A large cement and concrete building by itself is not very attractive unless the harshness of this structure is mellowed by appropriate landscaping.
2. In large cities, due to shortage of space, hardly any compound is left around the buildings for gardening. Therefore, in most of such buildings potted plants and a few indoor plants should be arranged to decorate the entrance and corridors.
3. Where space is available, lawn should be laid out with flower beds and few shrubs at the border.
4. The entrance and exit roads should be lined with flowering trees. The kind and size of the trees will depend upon the size of the building. Non spreading large trees should be selected.
5. Some flowering climbers should be trained over the portico. One or few bougainvilleas or flowering creepers can also be trained over the front walls.
6. A few shade and flowering trees and a lawn should be planted in overcrowded public buildings like court. It will provide a resting place for the people.
7. In Dak bungalows and travellers' bungalows where sufficient space is available, miniature garden with lawn, flower beds, shrubbery, lily pool, fountain and a few specimen tree should be planted.
8. Fountain fitted with coloured lights can also be added.
9. In hotel buildings, can add roof and indoor garden also.

Exercise:

1. Draw a design of garden for public buildings using coloured pencil
2. Enlist the plants suitable for public buildings:

Trees			
Common Name	Botanical Name	Landscape Uses	Flowering/Foliage
Climbers			
Potted Plants			
Seasonal flowers			
Season	Common name	Landscape Uses	

Practical No: 8

Title of the exercise: **Study and design of traffic islands**

Traffic Island is physical structure or a painted object found on roads and roadside. It serves various purposes depending on its type. It is usually seen as a raised area along the road for a better & orderly flow of traffic or act as a stopping/ resting area for pedestrians. In few countries traffic islands are also referred to as channelizers as these channelize the traffic ply on the road. These may be raised structures made up of concrete or a physical structure in form of boards, barricades, traffic cones etc.

Design and Geometrical Features of Traffic Islands

Since traffic island is a common name given to various road structure and markings, these can be grouped based on the use, location, size, construction type and material etc.

1. **Shape and size:** The shape & size of traffic island is determined on the basis of function it is meant to serve. Like in case of median it's much longer in length than width because its function is to divide the flow of traffic. In case of a channelizer the function of traffic island is to channelize the flow of traffic in a particular direction. These are sometimes elongated like in case of channelizers. These can also be round like in case or rotatory and round about which are used for giving a larger maneuvering space to drivers.
2. **Location:** Traffic island can be present on the side of road, across the road or even in mid way along the road. The functional classification of island is the most important determining factor of the location of an island.
3. **Island type:** The decision of using a painted, concrete structure, traffic cone etc., rests with the transportation department and can be chosen as per the economics and the extent to which these fulfill the requirement. However if the traffic volume is substantial, concrete structure is generally used as it forces the user to follow it, painted lines work where people are law-abiding and the flow of traffic is relatively less.

Classification and Types of Traffic Islands

There are three main classifications involved based on the purpose they serve. The purposes served may be more than one depending on their geometry, location, size and shape:

1. **Channelizing Island**
2. **Divisional Island**
3. **Refuge Island**

Exercise:

1. Make a design of garden for traffic island by using colored pencil.
2. What are the geometrical features of traffic island.

Practical No.9

Title of the exercise: Study and design of factories

The places where garden can be laid in the factory area are canteen, rest-shed, hospital, administrative building, etc.

The chief objectives of landscaping industrial areas are

1. To reduce pollution caused by hazardous gases
2. To improve microclimate
3. To reduce the wind velocity by using tall evergreen trees
4. To improve aesthetic values
5. To reduce noise

Basic components

1. The basic components of industrial landscape designs are concrete benches, steps, wooden decks and stone lanterns.
2. Proper care should be taken while choosing and planting a specimen tree or a shrub as it is a vital component of the whole garden with regard to its position and beauty.
3. It is also equally important to cover or conceal undesirable features in the landscape using a live hedge.
4. During planning for a lawn, the cost and efforts required to maintain it are to be considered. Lawns need proper maintenance such as fertilizing, weeding, watering and mowing.
5. Shrubs, trees, hedges, ground covers, edging plants and lawns can be used in different ways in the design of a garden for sharper accent, greater shade, or screen surfacing to give depth.
6. In the case of mixed borders or a bed, annuals of different heights and blooms of varying colours can be raised.
7. Mostly, ground covers with dense growth and lush foliage should be used in an area that does not have much traffic passing through it.
8. The main function of a path is to link up the different dominant features in a garden or to connect the wicket gate to the main entrance door or the building.
9. The choice of material could be an informal, rectangular or oval paving or a crazy concrete paving.

Desirable characteristics of trees for an industrial landscape-

1. Broad leaves with rough surface
2. Pubescence
3. Large number of stomata
4. Efficient in tapping dust and other particles

Exercise:

1. Make a design garden for factories by using coloured pencils.
2. Write the objectives of landscaping industrial area.
3. Enlist the common trees used in factory premises.

Sl.No.	Common Name	Botanical name	Purpose
1.			
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Practical No: 10

Title of the exercise: Planning and planting of avenues for state and national highways, airports and railway stations.

Landscaping of highways is not only the planting of trees but also enhance the beauty and fits it into the natural landscape of the area.

Main purpose of planting of avenues trees is:

1. To provide shade during summer
2. To control erosion of soil
3. To reduce noise pollution

General recommendation:

1. Evergreen trees with spreading crown should be selected for highways planting.
2. For wider roads, double rows can be planted, with outer rows having shade trees and the inner rows with flowering trees.
3. The high way trees never be planted in mixed avenues, but only one species should be planted for a long distance of the road. It will provide more beautiful looks and wavy appearance to the skyline.
4. The tree should be planted 12 m apparat in the row and at least 5-6m away from the edge of the road, so that they got enough space for spreading and do not interfere with traffic.
5. If the road is wide as 30m or more, double rows of trees should be planted, rows being spaced 10-12 m apart.
6. Trees with shallow root system such as *Millingtonia hortensis* and brittle wood as in case of *Eugenia jambolana*, *Albizzia lebbek, Cassia siamea*, Eucalyptus should never be planted on highways, as during storms they get uprooted or branches are broken and causalities may result on the un aware road users.
7. Thorny trees should not be planted on highways, as the falling thorns may cause damage the tyres of vehicle.
8. Shrubbery borders with suitable shrubs can be maintained along the highways. This will improve the scenery.
9. *Samanea saman* and *Dalbergia sisso* grow better in places having a rainfall of 100cm or above. *Ficus benghalensis* can be planted singly and a little away from the road at some distance, for its cool shade. *Albizzia procera* is a good road side tree.

Exercise:

1. What are the criteria followed for roadside planting?
2. Draw a design of avenue planting for highways using coloured pencil.
3. Enlist the avenue trees suitable for landscaping of highways:

Flowering trees:

Common Name	Botanical Name	Season of Flowering	Flower Colour	Evergreen/ Deciduous

Non- flowering trees:

Common Name	Botanical Name

Shrubs:

Common Name	Botanical Name	Flowering/Non flowering

Landscaping of airport and railway station:

- Airport should be beautified by planting of ornamental trees, lawn, flower beds and displaying plants in tubs and troughs.
- Besides flowering and foliage trees, a railway platform can be beautify with tubs and troughs planted with palms and other attractive plants such as bougainvilleas.
- Hanging baskets can be displayed near the booking office or the pillars of resting sheds.

Exercise:

1. Make a planning and design of garden for airport and railway station
2. Enlist the plants suitable for airport and railway station:

Flowering trees:

Common Name	Botanical Name	Season of Flowering	Flower Colour

Non- flowering trees:

Common Name	Botanical Name

Potted plants:

Common Name	Botanical Name	Flowering/ Foliage

Practical No: 11

Title of the exercise: Design and establishment of Japanese garden

- The origin of Japanese style of gardening goes back to the era of Empress Suiko (592-628 A.D). Japanese garden designs were based on their respective ideas of heaven.

Exercise: Write down the features of Japanese garden

Types of Japanese garden:

1. Hill garden:
2. Flat Garden:
3. Tea Garden:
4. Passage Garden:

5. Sand Garden:

Trees suitable for Japanese garden:

Evergreen tree	
Common Name	Botanical Name
Deciduous tree	
Shrubs	
Climbers	

Practical No: 12

Title of the exercise: Design and establishment of English garden

- British garden architect Repton and Capability Brown advocated the concept that the British garden should look like countryside.
- Their main idea was that the gardens should merge with the countryside without any artificial barriers such as fences, hedges.
- The history of gardening in England dates back to fourteenth century. By the middle of sixteen century the English garden saw flower beds, topiary and terrace gardens.
- In the middle of eighteen century gardens were laid out with more emphasis on architectural features. The main features of gardens during this period were curved paths, in formal group of trees, artificial water falls and clipped hedges.
- The main stay of an English garden came into prominence during the nineteen century.
- The main features of English garden are lawn, herbaceous border and rockery.
- Plants used in English garden are carnation, lavender, lilies, conifers mixed with board leafed deciduous trees, mulberry, apple, peach, cherry trees.

Exercise:

1. Write down the features of English garden
2. Draw a design of English garden using coloured pencil
3. Enlist the plants suitable for English garden.

Category	Common Name	Botanical Name

Practical No: 13

Title of the exercise: Design and establishment of Mughal garden

- The gardens laid out during the rule of Mughal Emperors in India are known as Mughal gardens.
- The Mughal gardens are similar to the style of gardens of Central Asia and Persia.
- Babar (1494 – 1531) was the first Mughal ruler to introduce this style in India.
- All other Mughal rulers and some of the Mughal Begums starting from Akbar and followed by Jahangir, Nur Jehan, Shah Jehan, and Aurangzeb all laid their hand on developing one or the other Mughal gardens in India.
- The main features of Mughal gardens, which are largely borrowed from the Persian style

The main features of Mughal gardens, which are largely borrowed from the Persian style, are:

1. Site and style of the design
2. Walls
3. Gates
4. Terrace
5. Nahars or running waters
6. Baradari
7. Often a tomb or a mosque and
8. Trees

Exercise: Write down the features of Mughal garden

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2. Enlist the plants suitable for English garden.

Category	Common Name	Botanical Name

Practical No. 14

Title of the exercise: Visit to public gardens

Exercise:

1. To visit public, institutional and botanical gardens.
2. To collect, study and conserve indigenous plant species.
3. To observe and study different garden designs.
4. To be familiarized to the documentation process and maintenance of indigenous and exotic plant species.
5. To evaluate the varietal distribution of indigenous & exotic plants from various public, institutional and botanical gardens.
6. To maintain a detailed self-prepared record of all the observations made on such visits.

Sl. No.	**Components**	**Observation**
1	Place of Visit	
2	Type of garden	
3	Type of plant spp.	
4	Type of flower crops	
5	Type of tree spp.	
6	Type of elements in the garden	

Practical No. 15

Title of the exercise: Visit to institutional gardens

Exercise:

1. To visit institutional gardens.
2. To collect, study and conserve indigenous plant species.
3. To observe and study different garden designs.
4. To be familiarized to the documentation process and maintenance of indigenous and exotic plant species.
5. To evaluate the varietal distribution of indigenous & exotic plants from various institutional gardens.
6. To maintain a detailed self-prepared record of all the observations made on such visits.

Sl. No.	**Components**	**Observation**
1	Place of Visit	
2	Type of garden	
3	Type of plant spp.	
4	Type of flower crops	
5	Type of tree spp.	
6	Type of elements in the garden	

Practical No. 16

Title of the exercise: Visit to botanical gardens

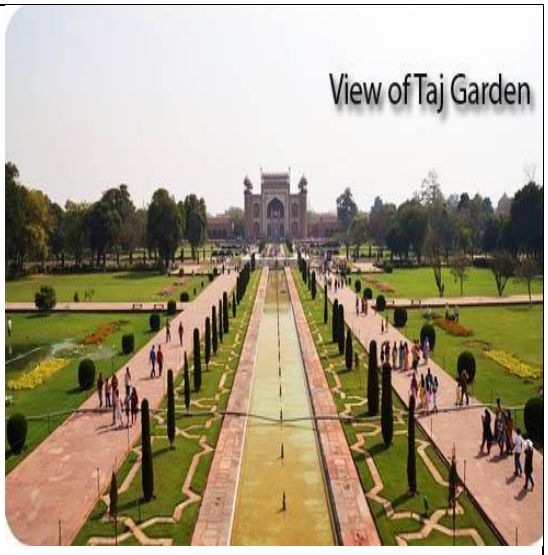
Exercise:

1. To visit botanical gardens.
2. To collect, study and conserve indigenous plant species.
3. To observe and study different garden designs.
4. To be familiarized to the documentation process and maintenance of indigenous and exotic plant species.
5. To evaluate the varietal distribution of indigenous & exotic plants from various institutional gardens.
6. To maintain a detailed self-prepared record of all the observations made on such visits.

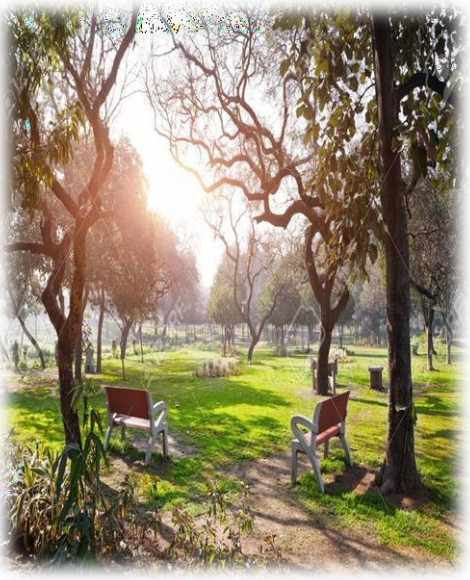
Sl. No.	**Components**	**Observation**
1	Place of Visit	
2	Type of garden	
3	Type of plant spp.	
4	Type of flower crops	
5	Type of tree spp.	
6	Type of elements in the garden	

Appendices:

Formal garden and informal garden



Taj garden of New Delhi, Formal Garden



Budha Jayati park, New Delhi , Informal Garden

Landscaping of Public Buildings:

Hyatt hotel Delhi

Supreme court New Delhi

NSE building

Reliance Head Office

Landscaping of highways, railway station and airport

Kolkata airport

Mumbai airport

	
Dharwad Railway Station	Chandighar highways

Mughal Garden :

	
Shalimar Garden , Kashmir	Chasma -sahi Garden, Kashmir

	
Rashtrapati Bhawan Garden	Pinjur garden , Punjab

Features of Mughal Garden :

Site and Design

- Mughals were very choosy about the selection of site and always preferred a site on a hill slope with a perennial rivulet or along the bank of a river.
- Mughal gardens are generally rectangular or square in shape and different architectural features are the main stay of the design.

Walls and Gates

- The Mughals created the gardens not only for pleasure and recreation but also as forts and residences surrounded by high walls and with-an-imposing wooden gate at the entrance which was studded with bold iron nails and pointed iron spikes.
- The purpose of the high walls was security from the enemies and shelter against hot winds. The gardens were a place of peace for the Emperors to enjoy with their wives and concubines.

Terrace

- The Mughals came from the hilly terrains and so they were fond of terraces in the gardens.
- For this reason they used to select the location of gardens near hill slopes.

- Their fascination for terrace was so intense that even in the plains of Punjab they created artificial terraces.
- According to Islamic faith the Paradise has eight divisions and hence some times the gardens have eight terraces

Nahars (Running Water)

- The style of having running water by constructing canals and tanks borrowed from the Persians.
- The water canals were paved with tiles (or marble) of blue colour to create the illusion of depth.
- The course of water used to be maneuvered in various ways taking advantage of each slope, however small it may be, to break up the flow into artificial falls and ripples.
- The water canals used to have fountains to throw up the water high in the air. In the evenings small lamps used to be illuminated to create beautiful reflexions.
- The fascination for water came from the Muslim faith which says that the promised paradise is the place "where cooling waters flow". With this bias for water Mughals selected sites on hill slopes to tap a running rivulet or spring for source of water.
- In the plains of India, where the summers are hot, Mughals utilized water for its cooling effect.

Baradari

- This is nothing but an arbour-like structure, but made of stone and masonry with a puccaroof and a raised platform for sitting.
- These were usually provided with twelve or occasionally more doors on all sides forthe Emperors to watch the performance of the dancing girls.

Tomb or Mosque

- It was a common practice to have the gardens built around a tomb (e.g., Taj Mahal, Akbhar's Tomb at Sikandra).
- It is often said that the Mughal gardens were at their best when built around a monument.

Trees and flowers

- The trees were selected with careful planning and thought, as to Mughals each tree symbolized something, like life, youth, death, etc.
- Fruit trees were considered symbols of life and youth, while, Cypress represented deathand eternity. The Mughals had bias for spring flowering trees and flowers.
- The seasonal flower beds were of geometrical pattern and constructed along the watercanals or near the main buildings.
- The favourite flowers were rose, jasmine, carnation, hollyhock, delphinium etc.

Japanese garden:

Features of Japanese Garden:

Ponds

- The geometric shape does not live up to the Japanese tradition and hence all ponds areof irregular shape.
- The banks are generally bordered with stone piling work in a regular or an irregularfashion. In olden days the bottom used to be made impervious by puddling clay.
- But now-a-days concrete-bottomed ponds are also used. The ponds are generally fed by a stream or a waterfall.

Streams

- Small streams are arranged most naturally with natural stones bordering the banks. Theflow of water in the stream may be manipulated by changing the inclination.
- Sometimes it may be as fast as a mountain rivulet or like a smooth-flowing river of theplains.

Waterfalls

- The presence of waterfalls in Japanese gardens is another attempt in imitating nature. A waterfall may be made more effective by manipulating it to drop in two or three levels.
- To make the waterfalls dignified and natural, large-sized stones are arranged around these. The dense planting of evergreens around the waterfall also symbolizes mountain scenery where actually a waterfall naturally belongs.

Fountains

- Often natural fountains are provided near the foot of the hill, on the hillside or in theforest. Often water is conveyed from a hillside by means of bamboo-piping.

Wells

- In olden days wells in the garden were features of utility. In modern times this featureis more in the nature of an ornament than a utility.
- The wells may be square, circular or criss-cross in shape. The frame is generally constructed of stone but occasionally wood is also used.

- The frame is generally raised above the ground level to a height of 45-60 cm.
- The mouth of the well is often covered with a mat or a flexible lid knitted out of bamboo. Square-shaped buckets are hung on either side of the pulley, suspended froma rope.
- The well must be made very ornamental.

Islands

- There are four important garden islands, the first two types representing Sea Islands.

1. "*Elysian Isle"* (Horai-jima)" It is constructed in the middle of a lake and is never connected by a bridge. The beach is decorated with sand from the sea, shells, and pebbles. No fresh water vegetation is planted over this island. Often this island is given the shape of a tortoise.
2. "*Wind'swept Isle*" (Fukiagae-jima) It is also an ocean isle and constructed in a similar way. In addition to sand and shell, the beaches here are decorated with sea rocks.
3. "*Master's Isle*" (Shujin-to) It is placed in the foreground of the landscape so that it can be easily approached by a bridge from the bank. The "Master's Isle" generally has a summer house which is nothing but a thatched arbour. Besides the arbour, some selected trees, stones, stepping-stones, and one or two lanterns are included. Often the islands are in the shape of mounds or hillocks. Often the islands are made a peninsula, connected to the mainland by a narrow neck of land instead of a bridge.
4. "*Guest's Isle*" (Kiakujin-to) It is located in the background and is accessible by bridges and stepping-stones.

Bridges

- These are used to reach an island or for crossing a stream. Bridges may be made of stones, polished or un-worked earth, wood, and other materials.
- The Japanese concept of a bridge is not just a quick crossing of a water way. The aim is to prolong the crossing time so that the visitor gets enough time to enjoy the sceneryaround.
- The earthen bridge is constructed by first putting a wooden framework over which bundles or small logs are laid across and then these are covered with about 15 to 20 cm layer of earth and gravel.

Water Basins

- The water-basins are fitted near a house meant for the guests to rinse their mouth and wash the hands. But in present days these basins have become nothing but ornamentalfeatures.
- A small house may have a basin one meter tall; whereas in front of a large house the basin becomes as tall as 2 to 2.5 m and thus making useless as a place of washing, butremains there as an ornamental feature. The basins are generally fitted with an ornamental lid.

- The water-basin comes in various shapes, the most common ones are in the shape of anurn. But square-star shaped, cylindrical, stone-bottle shaped, and bowl shaped basins are also quite common. A screen-fence is provided near the water-basin to screen off unwelcome sight.
- Stones are placed at the base of the water-basin to arrest the splash of water which otherwise may wet the space below the veranda. A lantern is provided nearby for illumination.

Stone lantern

- Stone lantern is an important feature of any Japanese garden. The usual stone used is granite, but sand stone or white marble may also be used. The latter one is specially used for "Snow-Scene" type of lantern.
- The usual places of fixing the lanterns are near the base of a hill, on an island, on the banks of a lake, near a water-basin or a well, along a path, on a boat-landing, near waterfalls, and a bridge.
- The lanterns are used singly but along with a combination of rocks, fences, water- basins, shrubs and trees.
- The lanterns are not exactly meant for illumination but as objects of ornaments. Even when a lantern is lit in the night, the light emitted hardly illuminates the place becausemostly a group of bushes are grown near it. The object of illumination then becomes adim mysterious glow.
- When a lantern is near a river bank, this is lit to have red reflection on the water surface.
- A lantern has six parts, namely, the ornamental top, cap, light chamber, middle stand, post, and base. These may be of various sizes and shapes. The size should be in proportion to the building or the other garden features around the lantern.
- The first lantern was erected in Japan in the seventh century by the son of Emperor Suiko. Lanterns looking of age are valued much and may people make the lanterns lookold by artificial means.

Stone

- Stones are selected according to size, shape, and colour.
- No stone should be disproportionate to the size of the garden or the features around it, like a lantern or a water basin.
- The stones are rarely placed in isolation but rather arranged in groups of two to five. Each group will have stones of various heights and shapes.
- All stones must be arranged with a firm foundation as stones of unstable nature show the weakness of a garden design.
- The principle governing the arrangement of stones is to make them look natural. For this purpose, low-growing bushes or upright trees are planted near the stone groupingsdepending upon the size of the nearby stones. Naturally, the size, shape, and colour of the stones vary according to the purpose and the place of their use. Accordingly, the stones on a hill, on the blanks of lakes or streams, and near water cascades vary in their shape, size, and ornamental feature.

Pagodas

Another favorite feature of Japanese landscape is the stone tower or the pagoda which is a structure consisting of two, three, five, or more separately roofed stages.

Fences and gates

- Fences in a Japanese garden are of two types, one is for partition, while the other is for the purpose of screening which are called "*Sleeve Fences*". The latter type is so named as its shape resembles that of the long sleeve of a lady's Kimono.
- The partition fences should look light in appearance and hence wood and twigs of bamboo are preferred to stone.
- The screen fences are meant for covering something which is not pleasant in sight. This is made of wood or bamboo (whole or split or twigs) woven into patterns thus giving it an artistic look so that it can stand on its own in the garden as a feature of ornamentation.
- There are generally two gates, one is the front entrance and second the back entrance. Gates are also made of light materials such as wood or bamboo. Some gates are bare while others are roofed. The roof may be made of bamboo, wood, or simply thatched.

Vegetations

- The initial step in a Japanese garden is to decide the contours of land and water.
- Then comes the arrangement of principal rocks which are of primary importance in a Japanese garden as these forms the basic structure or the skeleton of the garden.
- After the stones, the secondary garden framework, i. e, the evergreen plants, are arranged. The trees are of permanent nature and stand as reference points in the garden.
- Time and again it has been told that the aim of a Japanese garden is to imitate nature by using natural elements, and hence, there is hardly any bar in using any plant material which serves this purpose. The Japanese use both needle-leaved and abroad-leaved trees in their garden.

Types of Japanese Garden

The Japanese gardens are further classified based on positions, shape, and purpose. The important types are,

Hill Garden

- This style is known in Japanese as 'Tsukiyama-niwa, meaning hills and water. The hill garden is made up of one or more hills designed with earth mounds and exposed weathered stones.
- The other features of this garden area water in the form of a stream or a pond or waterfalls or all the three with or without islands and also bridges, lantern, stones, and trees.

- The important points in the garden are decorated with stones and selected trees. But pine trees may be planted to give the effect of being swept by wind.
- Untrimmed stepping stones are placed over the walks. An island is generally a usual feature in a hill garden

Flat garden

- As the name implies, Hira-niwa or flat gardens are laid out in flat ground without hills or ponds. Flat gardens are supposed to represent a mountain valley or a meadowland.
- These gardens were popular during the era of Muromachi (1392-15723).
- A Fat garden is not necessarily as flat as a pan-cake. Since it stimulates a mountain valley, low rounded hills designed with the help of stones or earth mounds or both will look quite appropriate in a flat garden.

Tea garden

- The tea garden is laid out based on certain principles and customs of the Japanese tea ceremony and hence needs a considerable space of at least about 200 square meters, for its desiging.
- Since the performance of the tea ceremony needs an atmosphere of intimacy, it is essential that the garden be enclosed by a fence.
- But the fence should be rustic in mature, with a gate made of very light material such as bamboo.
- To protect the tea house from the noise of the outer world, the tea gardens are divided into an outer garden (soto-roji) and inner garden (uchi-roji).
- The outer tea garden is comparatively a narrow area, with a waiting place where the guests are supposed to wait until the master of the house appears to welcome them.
- The inner garden contains the tea house. The tea house of the classical time was nothingbut a small straw hut with an outside waiting place, a small side room for washing the utensils, and the main ceremonial tea house itself having a capacity to accommodate only five persons.
- The most important feature at the entrance of the tea house is a water-basin or a well orboth for the visitors to rinse their face before entering for the tea ceremony. To illuminate the water basin and resting place stone lanterns are set in appropriate places.
- The selection of water-basin and stone lanterns is done with scrupulous care so that both the purposes of utility and beauty and elegance are fulfilled.
- As far as tree planting is concerned, a contrast is maintained between the outer garden and the inner garden. The outer garden will have simple plantings and stone groupings.
- The entrance to the tea house is through a low-door so that the guests have to enter in a bending posture, simulating respect and humility

Passage garden

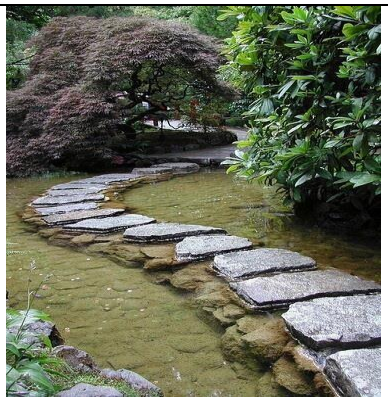
- The passage gardens, the Roji-niwa, are those which are laid in narrow passage, as forexample a narrow space between two houses or approaches to buildings.
- As such areas are generally narrow, the garden lay-out should be simple and not over crowded.
- In such gardens there should be hardly any ornaments such as lanterns, basins or otherman-made features. The common features of a passage garden are a few key rocks, slabs of stones, and only a couple of types of plant.
- Bushy shrubs and trees are unsuitable in a passage garden; instead, plants with open form and slender shapes are selected.
- The passage gardens generally occur as an accidental necessity in a narrow passage formed by two buildings of a large property. But occasionally a narrow passage is purposively created to simulate a distant prospect.

Sand garden

- It is the simplest style of gardening, though not liked by many as it is totally devoid ofplants. The main feature of this style of gardening is to arrange few vertical and prostrate stones in groups of 2 or 3 and to fill in gap between the stones with fine whitegravel.
- The gravel is raked in most simple patterns simulating the ripples of flowing water.
- The raking has to be repeated often to keep the garden in its best shape. This style of garden looks pleasant and effective only when confined to a limited area.

Plants suitable for Japanese garden:

- **Evergreens**: Pines, different species of *Abies*, *Cryptomeria japonica*, *Podocarpus macrophylla*, and *Juniperus chinensis*;
- **Deciduous**: Maples (*Acer* species), Poplars (*Populu*s sp.) Mulbery, (*Morus alba*),and *Salix babylonica* (willow)
- **Flowering:** The most commonly used plants are different *Prunus* species, besides *Magnolia grandiflora* and others.
- **Shrubs**: *Aucuba japonica, Azaleas, Gardenia florida, Nandina domestica, Camellia, Lagerstroemia indica, and Rhododendron*

 Hill garden	 Flat garden
 Tea garden	 Passage garden

Sand garden