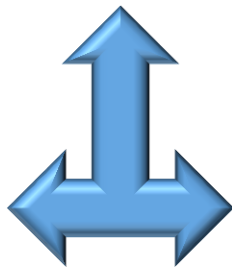


Ornamental Horticulture



1. Ornamental Horticulture (HPF 100) 3 (2+1)

History, scope of gardening aesthetic values. Gardens in India, types of gardens. Landscaping, historical background, definition. Floriculture industry: importance, area and production, industrial importance in India. Landscaping, basic principles and basic components. Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses and cacti succulents. Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds. Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens.

Practical: Identification and description of annuals, herbaceous, perennials, climbers, creepers, foliage flowering shrubs, trees, palms, ferns, ornamental grasses; cacti succulents. Planning and designing gardens, layout of location of components of garden study, functional uses of plants in the landscape. Planning design of house garden, roadside planting, avenues for new colonies, traffic islands, preparation of land for lawn and planting. Description and design of garden structures, layout of rockery, water garden, terrace garden, and Japanese gardens, recreational and children's corner. Layout of terrarium, traffic islands, bottle garden, dish garden. Flower arrangement, bonsai practicing and training. Visit to nearby gardens. Identification and description of species/varieties of jasmine, chrysanthemum, marigold, dahlia, gladiolus, carnation, aster and their important inter-culture practices. Practical: Practice in judging the maturity of various horticultural produce, determination of physiological loss in weight and quality. Grading of horticultural produce, post-harvest treatment of horticultural crops, physical and chemical methods. Packaging studies in fruits, vegetables, plantation crops and cut flowers by using different packaging materials, methods of storage, post-harvest disorders in horticultural produce. Identification of storage pests and diseases in spices. Visit to markets, packaging houses and cold storage units.

Lecture No.21

Landscape Design for a 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 home ground. There are some basic guidelines for a home landscape. But personal preferences play 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 house owner.

Making a plan



Before any actual garden work is undertaken, a master plan has to be prepared according to a scale (1: 15 or 1: 20) in which all the features such as house wall, driveway, paths, flower beds, shrubbery, etc., are plotted.

The shaded areas due to large tree canopy or the building itself have to be marked on the plan.

A plan prepared on a printed graph paper is of great help.

The plan thus prepared should be studied again and again keeping in view what shape a plant will take in the long run. It is frequently observed that people attracted by

the graceful form of a young *Araucaria cookii*, plant this in the centre of a lawn or near the house, not keeping in mind the gigantic form and height it will attain after some years. Perhaps the owner of the house will cut this tree when overgrown or it may be retained to the detriment of other plants growing below it. Either way, this is not a good planning. Perhaps, one way of satisfying the urge of a garden lover to grow such beautiful trees in a small compound, is to grow them in large concrete tubs and bury the tub growing the tree in the appropriate place, thus giving the impression that the plant has actually been grown on the ground. When this attains a considerable height, say 3-6 m, the tree along with the pot should be lifted and given to someone who can afford to use such a grown-up tree. But it is better not to include such controversial items.

Principle areas of a home garden

If the garden area is sufficiently large, it 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 area may be small or quite large depending upon where the building is situated. The aim is to harmonize or blend the surroundings with 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. Floribunda and miniature roses are also suitable for foundation planting provided sufficient sun, at least during the morning hours, is available. It is important to note that planting in front of the house should neither obscure it nor cut off light and air nor block the windows thus obstructing view of the garden from indoors.

Big trees, if space permits, can be grown 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 the service area and the living area should be situated at the back of the house as these need seclusion or privacy. The service area includes the kitchen garden, compost bin, nursery, tool shed, and garage. Some people like to include the children's swings and the slide in this portion as the children can be kept under surveillance from the kitchen. This area can be separated from public view by planting a thick hedge or a row of bushy shrubs.

(3) Private garden area or living area:

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. 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 annual 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. But before actual planning, one has to first decide what one wants for the house. The role to be played by the garden has to be chosen. A choice has to be made from the following.

- (a) An outdoor living room with a long stretch of lawn and terrace
- (b) A fenced playground
- (c) A show piece with collection of exotic and rare plants
- (d) A yielder of vegetables and fruits or cut flowers for the house



An outdoor living room

Some may like to add to the list a large tree for shade or trees to attract birds. People fond of vegetables and fruit may like to reserve the major portion of the area for this purpose with possibly a little area left around the house for a pleasure garden. But, if

the garden is desired as a place for outdoor living, a vast expanse of lawn with minimum of beds and borders has to be planned. 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.

Some points to be considered in designing a home garden

- To keep down maintenance cost and time, an untrimmed hedge should be preferred over trimmed one; open lawns and shrubs need less attention than annual flower beds.
- If the beds and borders in a lawn are edged with stone or brick, hand-clipping of grass will not be required.
- A pool needs to be cleaned occasionally and one should ponder twice before including this in the plan.
- The water outlets in the garden should be fixed at appropriate places so that the hoses are not dragged to long distances.

The above suggestions are for reducing the labour cost which is especially relevant in industrially advanced countries where labour is costly. Fortunately in India, labour is not so costly and one can include one or two features needing help of manual labour.

To create privacy, trees, hedges, shrubs, fences, or creepers trained on wire-mesh structure supported by angle iron or GI pipe pillars can be grown. Trees are used when height is needed, otherwise hedges and other types of screens should be preferred.

How to proceed

- The first thing is to select the materials for the basic framework such as background, screens, trees needed for shade, the doorway and the corner of the house.
- To this, the features needed for effects and beauty as for example, plants for foundation planting, flower beds, specimen shrubs or trees are added.
- After everything is finalized on paper, these are put into practice on the ground

with the help of split-bamboo stakes and rubber hose.

- The trees are represented by bamboo stakes, while the beds and borders can be plotted by bending a rubber hose in the desired pattern.
- Paths, hedge, or screen area can also be marked with stakes.
- Before implementing the plan, some compounds may need a little dressing-up like cleaning, leveling, and tidying-up.

Garden plans for small areas

For very small plots which cannot be divided into different segments such as public area, living area, and work area, one has to depend upon one's own imagination to do landscaping. However, care should be taken to choose suitable plants, especially for shady locations. For such plots situated under shade it is wise to put shade loving foliage plants and flowering plants preferring semi-shade such as *Impatiens sultanii*, geranium, day lily and football lily. Otherwise, a lawn planted with a few specimen shrubs or roses or one or two small beds of flowering annuals will be more than sufficient for small compounds situated in the open. In all probability it will not be possible to have any large tree in such compounds.

Actually landscape design has a wide flexibility and the same plot can be landscaped in two or more different ways. Moreover, opinion varies between one landscape designer and another. But the basic theories must be followed and mistakes such as overcrowding, monotony and placing of plants in wrong situations (e.g., a sun-loving plant placed under the shade of a tree) should be avoided. Once the design is decided, the different features such as paths, walls, pools, lawn are constructed as per the procedures suggested in this book. The basic necessities such as irrigation and drainage should also be taken care of.

Trees suitable for small gardens

While selecting trees for the home garden the following questions must be answered. First of all, why the tree is needed? Is it for a background or corner planting to frame the house; whether this is needed for shade for sitting or for the terrace and if so, whether grass will grow under shade? Once the questions are answered, the right type of tree has to be selected. Enough room has to be left for the tree to grow. As for example, a

25 x 50 m plot has room only for a large shade tree and two to three small flowering trees. Shallow rooted trees such as *Millingtonia hortensis* should not be planted as they are surface feeders and may be uprooted by storms.

Bauhinias, bottle brush, *Tecoma argentea*, *Mimusops elengi*, *Gliricidia maculata*, *Cochlospermum gossypium*, *Cassia fistula*, *Cassia spectabilis*, etc. are trees suitable for planting in home grounds.

There are some beautiful trees for the temperate regions some of which can also be tried in the plains of India. Cherries especially *Prunus sargentii*, is an outstanding flowering tree. Some ornamental peaches (*P. persica* 'Clara Meyer') look beautiful when in flowering. Some of the plums bear beautiful flowers out of which *Prunus cerasifera nigra* is possibly best for a home garden. Many of the maples are very ornamental in form and deserve planting in medium compounds. The weeping willow (*Salix babylonica*) and *S. pulrpurea* var. *pendula* are also very ornamental.

Some shrubs may be grown as specimens in the lawn. A few suggested shrubs are *Ixora singaporensis* and *Mussaenda philippica* for plains and Azaleas, Camellias and Rhododendrons for temperate climates. For shrubbery border a list of shrubs may be made from the chapter on ornamental and flowering shrubs, depending upon situation.

Roof garden

There is a misconception in India between roof gardening and terrace gardening. In many publications the gardening on the roof is often termed as terrace gardening which is not strictly correct according to the British concept.

In modern times, homes with a compound and lawn especially in cities and towns are becoming rare and skyscrapers are replacing such homes. As a result, the private home gardens are vanishing and the only places left for gardening are the roofs of houses and the balcony. A spacious and well-planned roof garden can be a place of joy and recreation. In bigger cities of India, many of the large hotels and public buildings are developing this type of gardening.

Depending upon the sun and the shade, the climate, the size of the roof, etc., the following plants are recommended for growing in the roof garden.

Flowering annuals

Antirrhinum, stocks, dwarf sweet pea, pansy, dahlia, chrysanthemum, marigold, sweet alyssum, phlox, pinks (*Dianthus*) and verbenas.

Herbaceous perennials

Pelargoniums, *Michaelmas daisy*, *Canna*, *Mirabilis jalapa*, *Portulaca*, *Solidago Canadensis*, *Vinca rosea* and perennial verbenas.

Shrubs

Many of the dwarf and medium shrubs can be grown.

Trees

One or two dwarf trees such as *Plumeria* sp., *Callistemon lanceolatus* and *Gliricidia maculata* can be grown as specimen plants. Some large to medium trees such as *Araucaria cookii*, *Mimusops elengi*, *Brassaia actinophylla*, etc., can also be grown till they are young.

Bulbs A variety of bulbous plants of annual or perennial nature can be grown.

Water plants

Water lilies and other water plants can be grown in the lily pool or in cement tubs.

Vertical garden

In cities people living in flats have very little space for the conventional type of gardening, but can easily afford to put up a vertical garden. A vertical garden can be shifted from place to place and even used as an ornamental partition in the drawing room. Since the aeration and the drainage of the medium are perfect, shallow-rooted plants needing very little anchorage will grow well. The vertical garden should be planted with either sun-loving dwarf or trailing flowering annuals such as *Alyssum*, *Pansy*, *Nasturtium* etc. or shade loving foliage plants such as *Fittonia*, *Peperomia*, *Oxalis*, *Zebrina pendula* etc., or flowering begonias. The vertical garden is provided with legs on the sides to enable it to stand on its own.

Questions

1. The approach area in a house garden should be overcrowded with large trees.

Ans: False

2. Mention two trees suitable for home garden

Ans: *Mimusops elengi*, *Gliricidia maculate*

3. Mention two shrubs suitable for home garden

Ans: *Ixora singaporensis*, *Hibiscus rosasinensis*

4. Mention two annuals suitable for home gardens

Ans: *Petunia*, *marigold*

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Lecture No.22

Landscape Design for Recreational Gardens and Children's Parks

Children's parks and school gardens

The concern for the plants, love for plants and knowledge about plants have to be imparted to the younger generations along with other educational activities. A good relationship and interaction with plants will pave way for a better environment, healthy family, peaceful societies, stable government, etc.

Presenting attractive plants to the children will create interest and love among children. Gardening kits for children is another important aspect to be considered. Small handy gardening tools given to the children will automatically tempt them to use and involve them in gardening activities.

Several studies have shown that plants have a positive effect on the body, mind and soul. Gardens and gardening activities have been utilized for improving not only the physical health but also the mental health. Mentally handicapped people can be rehabilitated easily by bringing them to the gardens and allowing them to participate in the garden activities.

Gardens for cities

In a city, there may be parks of several sizes from very large to medium size and also squares or small gardens are generally found at street intersections. The small gardens or squares are planted with a view to relieve the eyes of the people passing by them or for a short resting period for those who care to use them. Therefore, these may be planted with a patch of grass, few flower beds, one or two shade or flowering trees or a group of shrubs and trees. The medium to large parks are meant for a place of recreation and these are considered as lungs of the cities. These should be a place of beauty as well as utility.

A small city park may be an area anything between 5 and 100 hectares or little more. A large rural park gives a degree of seclusion from the city but the small city park, as it is situated within the city, has no such characteristic although the features may be the same as that of large rural park. In the small parks, the scenery created will not look as

natural as those of a large rural park because of the limitation of space. A small park should have enough strolling space for the citizens. Good flowering and shade trees should be planted in groups or singly in some corners or other suitable places for creating beauty as well as a place for resting. Garden benches should be constructed at regular intervals especially under the shade of the trees. Few interesting and rare shrubs should also be included. Besides these, some garden adornments such as statues or fountains can also be planed in appropriate parts of such parks.

The third category of city parks may be called as pleasure grounds which have large reserve areas for playing games and often this is the main feature of these parks. A restricted swimming pool is also often a feature of a pleasure ground. If it is meant for the children, features such as swings, see-saw, sliding chute, etc. should form part of the park. Due to hard usage it is almost impossible to maintain grass area within this park. Some trees and shrubs may be planted aesthetically to make the view pleasing to the eyes.

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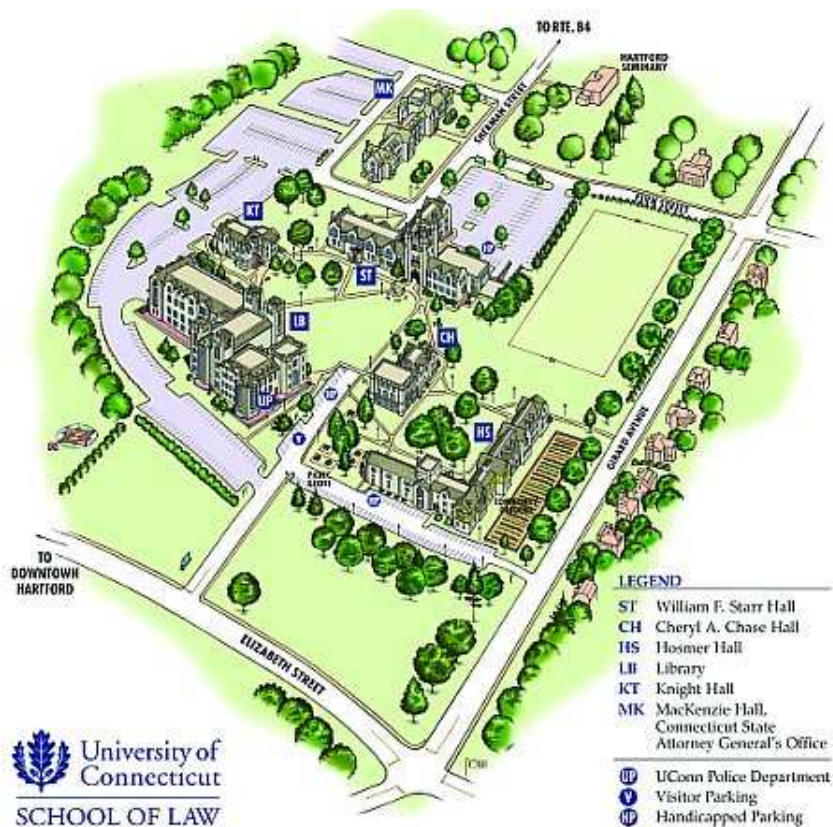
Lecture No.23

Landscape Design for Educational Institutions

Significance

A planned and properly landscaped school 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 recommendations

- Planting large trees along the school compound and the rear and wings will help to bring down noise and cut down dust and storms. This plantation will also help to keep down severe heat and cold.
- The front should be planted with medium-sized flowering trees for beauty.
- The trees should not completely obstruct the view of the building from outside.
- 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.
- 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.
- The roads and paths are to be formally planted with medium to tall flowering plants.
- Before planting, provision should be made for overhead wiring and sewerage so that these do not interfere with the avenue planting.
- 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.
- A lawn looks good in an educational institution, but is very difficult to maintain. The playground can be planted with lawn, if this can be maintained or should be left bare.
- A thickly planted belt of eucalyptus for peripheral planting is considered ideal. Silver oak, *Polyalthia* and *Samanea saman* are also suitable for this purpose.
- *Cassia fistula*, *Tecoma argentea*, *Erythrina indica*, *Lagerstroemia flos-reginae* and *Bauhinia variegata* are suitable for planting in the front and in the front row of the border planting.
- The roads and paths are to be formally planted with medium to tall flowering plants.
- Shrubs play an important part in the school landscaping. Shrub borders can replace hedges in parks or playgrounds since they are very effective and also the maintenance is minimum.

- Climbers such as *Bignonia venusta* supported against a wall would look beautiful. Creepers climbing with their rootlets such as *Ficus repens*, *Tecoma radicans* can also be trained over stone or brick walls.
- 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.

Questions

1. Mention two creepers that can be trained over stone or brick walls

Ans: *Ficus repens*, *Tecoma radicans*

2. Colleges can maintain a ----- where the plants are arranged in groups, family wise so that such gardens become educative.

Ans: Botanical garden

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Lecture No.24

Landscape Design for Industrial Areas

Objectives

The chief objectives of landscaping industrial areas are:

- To reduce the wind velocity by using tall evergreen trees
- To reduce pollution caused by hazardous gases
- To reduce noise
- To improve microclimate
- To improve aesthetic values



Industries may be broadly categorized into two groups. The first group comprises comparatively neat factories such as a plywood factory or a fruit processing plant which emit less dust and other polluting materials. The second group consists of factories such as cement, steel, fertilizer, etc. which emit a lot of dust, smoke, and harmful chemicals.



Landscape for an industrial area

(Courtesy : <http://go2.wordpress.com>)

The primary aim in a factory garden will be to plant trees to arrest the drifting dust and smoke and to cut down noise. Another important aim is to provide ample shade and coolness so that the workers get a respite under the coolness of trees from the hostile hot interior of the factory. Moreover the trees bring down the temperature in the factory

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

Planning

For planning a well designed industrial landscape, the following parameters are to be taken into account.

- Weather parameters of that location
- Type of soil, pH, depth, problems of drainage and soil erosion.
- Water source, quality and availability
- Native plant species
- Nature of bird and animal habitat

Principles

The following fundamental principles are to be followed for a good industrial landscape.

- i) Simplicity in design should be the key note and undue complexity is to be avoided.
- ii) Variety in a garden gives pleasure. But attempting too much in a small space is not desirable.
- iii) The ground should be so designed that the entire garden is not visible at a glance. It should be full of surprises, with each turn of the path revealing fresh vistas, or disclosing new interests.
- iv) Long and straight garden paths should be avoided.
- v) Judicious employment of more number of plants of different varieties is desirable
- vi) Colour and contrast in the garden are very much desirable which would help in creating a relaxing environment for the tired employees.



Basic components

The basic components of industrial landscape designs such as concrete benches, steps, wooden decks and stone lanterns should be mostly from the plant material as they serve definite functions. For instance, 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. It is also equally important to cover or conceal undesirable features in the landscape using a live hedge. Lawns need proper maintenance such as fertilizing, weeding, watering and mowing. So when planning for a lawn, the cost and efforts required to maintain it are to be considered.

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. In the case of mixed borders or a bed, annuals of different heights and blooms of varying colours can be raised. Mostly, ground covers with dense growth and lush foliage should be used in an area that does not have much traffic passing through it.

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. 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

- Broad leaves with rough surface
- Pubescence
- Large number of stomata
- Efficient in tapping dust and other particles

Trees suitable for landscaping industrial areas

Trees tolerant to SO₂

- *Casuarina*
- *Albizzia*

- *Acacia nilotica*
- *Delonix regia*
- *Moringa oleifera*
- *Eucalyptus*
- *Morus alba*
- *Psidium guajava*
- *Syzygium cumini*

Trees tolerant to Fluoride

- *Ailanthus excelsa*
- *Cassia fistula*
- *Eucalyptus*
- *Ficus* sp.
- *Thuja compacta*
- *Artocarpus*
- *Pithecelobium dulce*

Trees for thermal power and cement factories

- *Ficus* spp.
- *Azadirachta indica*
- *Tamarindus indica*
- *Butea monosperma*
- *Lagerstroemia indica*
- *Tectona grandis*
- *Grevillea robusta*
- *Holoptelea integrifolia*

Trees to manage smoke and CO₂

- *Ailanthus excelsa*
- *Azadirachta*

- *Bougainvillea spectabilis*
- *Cassia fistula*
- *Delonix regia*
- *Moringa oleifera*

Mechanization of garden

Industrial gardens have to be as far as possible mechanized to reduce the labour requirement. For watering, rain guns, sprinklers and drip irrigation systems can be adopted. This will save the water as well as labour. Further, power operated lawn mowers, sprayers and weed cutters can be used instead of manually operated ones to save the time and labour.

Questions

1. The chief aim of landscaping industrial areas is to reduce
a. wind velocity b. pollution c. noise d. all the above

Ans: d. all the above

2. ----- in design should be the key note in the principle of industrial gardening

Ans: Simplicity

3. Broad leaf with rough surface is a desirable characteristic of trees for an industrial landscape. State True or False

Ans: True

4. Give two fluoride tolerant trees suitable for industrial gardening

Ans: *Ailanthus excelsa*, *Cassia fistula*

5. Give two trees suitable for thermal power and cement factories

Ans: *Ficus sp.*, *Azadirachta indica*

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Lecture No.25

Landscaping of Public Places

Landscaping public buildings

The government and private offices, courts, auditorium, cinema halls etc. fall under this group. In large cities with paucity of space for gardening, growing plants in pots is the only possibility. But where space is available, a lawn may be laid with a few flower beds and shrub borders. The entrance and exit roads may be lined with flowering trees. The kind and the size of the trees will depend upon the size of the building. Dwarf trees in front of a sky-scraper will be a total misfit. Majestic-looking, non-spreading large trees will be the right choice for such buildings.



Landscaping of public places

Some flowering climbers may be trained over the portico. Once or few bougainvilleas or some other flowering creepers can also be trained over the front walls. If the compound is properly planted with a few shade and flowering trees and a well maintained lawn, the people will find a resting place.

Landscaping places of historic importance

The objective of landscaping such historic monuments is only a secondary one, keeping in view that the planting should not overshadow the monument. The best way to do this is possibly laying vast stretches of lawns around the monuments and planting some shade and flowering trees for beauty and to create places for rest. The trees should be selected depending upon the climate of the region.

Landscaping places of worship

The places of worship such as temples, *Gurudwara*, mosques, churches etc., offer a good opportunity for landscaping. In temples where offerings are made with flowers, it is important to have a garden with the right type of flowering plants. The association of *Plumeria acutifolia* is common with Buddhist temples. Shrubs such as jasmine, crossandra, barleria, hibiscus, ixora etc., are quite useful in a Hindu temple. Generally, there will be some water tank in the vicinity of a Hindu temple.



This may be planted with water lilies and lotuses and on the banks moisture-loving trees may be planted. Fragrant flowering trees like *Mimusops elengi* and *Michelia champaca* may be planted around the temple to create an atmosphere of serenity and sanctity. The flowers are useful for worship also. There should be enough open space in the front for the devotees to assemble under the shade of trees.

Gardens for cities

In cities, there may be parks of several sizes from very large to medium size and also squares or small gardens are generally found at street intersections. The small gardens or squares are planted with a view to relieve the eyes of the people passing by them or for a short resting period for those who care to use them. Therefore, these may be planted with a patch of grass, few flower beds, one or two shade or flowering trees or a group of shrubs and trees. The medium to large parks are meant for a place of recreation and these are considered as lungs of the cities. These should be a place of beauty as well as utility.



A small city park may be an area anything between 5 and 100 hectares or little more. A large rural park gives a degree of seclusion from the city but the small city park, as it is situated within the city, has no such characteristic although the features may be the same as that of large rural park. In the small parks, the scenery created will not look as natural as those of a large rural park because of the limitation of space. A small park should have enough strolling space for the citizens. Good flowering and shade trees should be planted in groups or singly in some corners or other suitable places for creating beauty as well as a place for resting. Garden benches should be constructed at regular intervals especially under the shade of the trees. Few interesting and rare shrubs should also be included. Besides these, some garden adornments such as statues or fountains can also be planned in appropriate parts of such parks.

The third category of city parks may be called as pleasure grounds which have large reserve areas for playing games and often this is the main feature of these parks. A restricted swimming pool is also often a feature of a pleasure ground. If it is meant for the children, features such as swings, see-saw, sliding chute etc. should form part of the park. Due to hard usage it is almost impossible to maintain grass area within this park. Some trees and shrubs are planted aesthetically to keep the pleasing to the eyes.

Questions

1. Give two tree species suitable for temples

Ans: *Michelia champaca*, *Plumeria alba*

2. ----- are considered as lungs of the cities

Ans: Parks

3. City parks may which have large reserve areas for playing games are called -----

Ans: Pleasure grounds

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Lecture No.26

Landscape Design for Railway Stations, Bus Terminals, Dam sites, Hydroelectric Stations, River Banks

Landscaping railway stations

One important aspect of bio-aesthetic planning is to landscape public places on a priority basis compared to private places. A well-kept and well-planted railway platform gives a visitor or a passerby the first impression about the town. For most of the people living in small towns the station platform is a place for evening recreation or a place for morning walk. The second important consideration why a platform needs to be planted with shade or flowering trees is that these trees offer the passengers a resting place under the hot sun, while waiting for the train.

Besides flowering and foliage trees, the railway authorities can also improve and beautify the platforms with tubs and troughs planted with palms and other attractive plants such as bougainvilleas. Even hanging baskets can be displayed near the booking office or on the pillars of resting sheds and in similar other places. Concrete seats or benches could be constructed around the trunk or under the canopy for the benefit of the commuters.



One more reason why the railway platforms should be beautified with trees is because many more people pass through a railway station compared to those who visit a public park.

Landscaping railway stations with avenues of flowering trees such as *Cassia fistula*, *Cassia nodosa*, *Peltophorum ferrugineum*, *Delonix regia*, etc. will provide shade to the visitors apart from beautifying the place.

Railways should have their own nurseries at suitable places for raising the plants needed for such landscaping work. The transportation of these trees to the different railway stations will be an easy task for the railways.

Railway lines

It will be a hard task to landscape the vast stretches of railway lines compared to landscaping the platforms, especially in the drier tracts of the country. Fortunately, in India we have got beautiful flowering trees such as *Butea monosperma*, *Cassia fistula*, *Erythropsis colorata*, etc., which can withstand considerable drought conditions.

The landscaping of railway lines poses some problems, the basic being watering. This can be partly overcome by planting drought resistant trees during the rains. In landscaping railway lines more emphasis can be placed on planting trees of economic importance, apart from ornamental plants. Other points which should be considered are that plants should be deep-rooted and non-spreading. A shallow-rooted plant will be easily uprooted by a storm and may cause obstruction on the track, whereas a spreading plant has to be trimmed now and again, to keep the track free. The trees are to be planted at a specified distance from the tracts as per railway regulations.

The innumerable railway level-crossings are the places, which can be landscaped with much ease than the railway lines, as the gate-man will be there to look after the plants. The beauty of such landscapes will not only be enjoyed by the railway passengers but also by the people who pass by the road or wait for the train to pass.

Plants for railway platforms and lines

The following trees are recommended for planting on railway platforms and lines.

(a) Ornamental species

Albizia procera, *Bauhinia variegata*, *Cassia fistula*, *C. javanica*, *C. nodosa*, *Delonix regia*, *Gliricida maculata*, *Jacaranda mimosifolia*, *Lagerstroemia* (different species), *Michelia champaca*, *Peltophorum ferruginum*, *Polyalthia longifolia*, *Saraca indica*.

(b) Economic species

Ailanthus excelsa, *Anacardium occidentale*, *Averrhoa carambola*, *Dalbergia sissoo*, *Mangifera indica*, *Melia azadirachta*, *Shorea robusta*, *Swietenia mahagoni*, *Tamarindus indica*, *Tectona grandis*, *Terminalia arjuna*, *T. catappa*

Ornamental trees recommended for town roads

Ornamental shade trees: *Alstonia scholaris*, *Anthocephalus cadamba*, *Averrhoa carambola*, *Ficus infectoria*, *Melia azadirachta* (Syn. *Azadirachta indica*), *M. azedarach*, *Polyalthia longifolia*, *Putranjiva roxburghii*, *Sterculia alata*, *Swietenia mahagoni*, *Tamarindus indica*.

Flowering trees : *Amherstia nobilis*, *Bauhinia purpurea*, *B. variegata*, *Brownea ariza*, *Cassia fistula*, *C. javanica*, *C. marginata*, *C. nodosa*, *Colvillea racemosa*, *Erythropsis colorata*, *Gliricida maculate*, *Jacaranda mimosaefolia* (*mimosifolia*), *Lagerstroemia flos-reginae*, *Peltophorum ferrugineum*, *Poinciana (Delonix) regia*, *Saraca indica*, and *Spathodea campanulata*.

Bus terminals and airports

The bus terminals should be beautified on the lines of railway stations. Airports should also be beautified by planting ornamental trees, lawns, flower beds and displaying plants in tubs and troughs

Landscaping highways

The landscaping of the national and state highways with trees is an important aspect of beautifying our countryside. Landscaping of highways does not mean only planting of trees; it is only one part of it. Landscaping of a highway also includes all other measures which help enhance the beauty and fits it into the natural landscape of the area. Besides its engineering perfection, a highway must look aesthetic, and should not disturb the ecological aspect of the area too much. Planting of trees on highways is necessary not only for the purpose of beautification but also for utility and necessity. The main purpose of roadside trees is to provide shade during the summer. For this purpose, evergreen trees with spreading crowns should be selected. For wider roads, double rows can be planted, with the outer rows having shade trees and the inner rows with flowering trees.

The planting of roadside trees started during the time of Emperor Asoka (268-231 B.C.). The Mughals also planted roadside trees.

Plants for highways

The roadside trees on the national highways should not only provide shade but preferably also have some economic value. With this in view, many of the highways have been planted with trees such as tamarind, mango, *Eugenia operculata* (Syn. *Syzygium operculatum*), etc.

Neem (*Azadirachta indica* ; Syn. *Melia azadirachta*), Mahua (*Madhuca indica*; Syn. *Bassia latifolia*), *Dalbergis sissoo* (Indian rosewood), and *Shorea robusta* are roadside trees of economic value.

The highway trees should never be planted in mixed avenues, but only one species should be planted for a long distance of the road. For example, if neem trees are planted in pure avenue for a long stretch, an oil extracting industry can be started on the roadside. Similarly, *Sal* yields valuable timber and its seeds yield an edible oil which is used as an ingredient in the manufacture of chocolates and other purposes. If a single species is planted in a pure avenue for miles together this looks more beautiful and gives a wavy appearance to the skyline. In such a case the management and gap-filling also become easier.

The trees should be planted 12 m apart in the row and at least 5-6 m away from the edge of the roads, so that they get enough space for spreading and do not interfere with the traffic. If a road is as wide as 30 m or more, double rows of trees should be planted, rows being spaced 10-12 m apart. The inner row may be of a flowering tree. If a roadside tree is intended for timber, replacements should be planted well ahead (4-6 years) of the cutting time.

The selection of trees for a particular locality is done giving due consideration to subsoil water, soil climate including rainfall, locality etc. As for example, if *Mahua* is planted along a highway near the tribal belts of Madhya Pradesh or Bihar, the flowers can be marketed easily as these are in great demand among the tribals. Trees with shallow root system such as *Millingtonia hortensis* and brittle wood as in the case of *Eugenia*

jambolana, *Albizzia lebbek*, *Cassia siamea*, and *Eucalyptus* should never be planted on highways, as during storms they get uprooted or branches are broken and casualties may result on the unaware road users. Neem and tamarind can grow very well in dry localities. *Samanea saman* (Syn. *Pithecolobium saman*) and *Dalbergia sissoo* grow better in places having a rainfall of 100 cm or above. Often the banyan (*Ficus benghalensis*) is planted on highways, which is not appropriate as its growth is unwidely. However, banyans can be planted singly and a little away from the road at some distances, for its cool shade. Similarly, *Ficus religiosa* is also not a very good roadside tree. On the other hand, *Albizzia procera* is a good roadside tree. *Polyalthia longifolia*, though not a tree of great economic value, is a very good shade tree and thus suitable for roadside planting. Thorny trees should not be planted along roadside as the falling thorns may damage the tyres of vehicles. Though not planted on our highways, shrubbery borders with suitable shrubs can be maintained along the highways. This will improve the scenery.

"Mixed plantation" consists of planting different varieties of trees in a mixed avenue against the planting of a single species. This has got a couple of advantages. The first is that the different plants flower and fruit at various seasons thus enhancing the aesthetic view for a longer time of the year. The other advantage is that this planting avoids monotony.

The other method is "group planting" where a group of 3-4 trees or more are planted at specified intervals instead of planting in avenue.

Informal planting method, which consists of planting informally without following any regular pattern is suggested for rural areas.

Landscaping banks of rivers and canals

The banks of the rivers and canals passing through towns and villages are well-suited for landscaping. The plants themselves will be objects of beauty and their reflection on the water surface is an additional attraction. Moisture-loving trees will do better along the waterfront compared to others. In India, the rivers Yamuna, Ganga, Kaveri etc. are regarded as sacred and on the banks of these rivers many old Hindu

temples are situated. The banks along these places may be planted with flowering trees, especially the sacred trees such as *Kadamba* (*Anthocephalus kadamba*) and *Asoka* (*Saraca indica*) which are associated with Lord Krishna and Sita.



The bank of the river Hoogly on the Calcutta side has been beautifully landscaped by the Calcutta Port Commissioners with shrubs and trees and has become a place for recreation for the citizens of the metropolis who can breathe fresh air away from the congested city. The vicinity of the river Gomti at Lucknow has also been aesthetically landscaped. River banks near places of historic importance, such as Taj on the bank of Yamuna, have also been landscaped with beautiful trees.

Besides beautification, planting of trees along banks of river and canals help soil conservation also. Since irrigation is not a problem, plants along canals and rivers once established will not need much care.

The following flowering trees are recommended for planting along the banks of rivers and canals.

Amherstia nobilis

Anthocephalus cadamba

Barringtonia acutangula

Bauhinia variegata

Cassia fistula

C.javanica

C. marginata

C. nodosa

Delonix regia

Lagerstroemia flos-reginae

Lagerstroemia thorelli

Melia azedarach

Peltophorum ferrugineum

Samanea saman

Saraca indica

Dam site landscaping

- Dam sites which generally look dull can be converted into a place of beauty
- By landscaping with beautiful trees such as *Cassia nodosa*, *C. javanica*, *Gulmohar*, etc.
- A garden or park can also be planned in such places, if space permits.
- The Brindavan Gardens in Mysore constructed below a dam site has become a place of great tourist attraction.
- Irrigation is not a problem for plants at dam site areas and once established will not need much care.
- The trees which are recommended for planting along the banks of rivers and canals are also suitable for dam site areas.

Questions

1. Mention two flowering trees suitable for landscaping railway stations

Ans: *Cassia fistula*, *Peltophorum ferrugineum*

2. Mention two trees with economic value suitable for railway platforms and lines

Ans: *Ailanthus excelsa*, *Anacardium occidentale*

3. Recommend two flowering trees for town roads

Ans: *Amherstia nobilis*, *Bauhinia purpurea*

4. The planting of roadside trees started during the time of Emperor

Ans: Asoka (268-231 B.C.)

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Lecture No.27

Interiorscaping

Significance of interiorscaping

With the growing number of people living in apartments now, the significance of interiorscaping is growing in leaps and bounds. Indoor plants are widely used in homes and commercial buildings such as offices, restaurants and shopping malls. They help us stay in touch with nature and in a sense, “bring the outside indoors.”

Environmental factors in indoor gardening

Light, water, temperature, humidity, ventilation and air flow are the chief factors affecting plant growth indoors.

Light

House plants are normally shade loving plants. Bright, but diffused light in a balcony or near a window also is a shady place and darkish corner on the staircase is also a shady place. What the shade loving plants need is bright-diffused light and not the dark places. Most shade loving plants will thrive if tender direct sunlight is available to them in early mornings or in the evenings. In open spaces too, where bright sunlight is available, the shade loving plants can be grown, but under shade nets or under coloured plastic sheets.

The environment in our homes dictates which plants will grow vigorously and which will suffer. The most important environmental factor in growing plants indoors is adequate light. Light provides the energy source needed for plants to manufacture food. The amount of light is commonly measured in lux. The interior of a well-lighted home is often less than 1000 lux, while outdoor light intensity on a clear sunny day may exceed 1,00,000 lux. Plants differ greatly in their light intensity requirements.

Classification of indoor plants based on light requirements

Based on the amount of light required for growth, indoor plants are often classified as follows.

S.No.	Category	Light requirement (lux)		Common examples
		Minimum requirement	Requirement for good growth	
1.	Low	750	1,000 - 2,000	Peace lily Heart-leaf philodendron Cast-iron plant
2.	Medium	1,000 - 1,500	2,000 - 5,000	African violet Boston fern Dumb cane
3.	High	1,500 - 5,000	5000 - 10000	Weeping fig English ivy <i>Schefflera</i>
4.	Very high	10000	10000+	Hibiscus Rex begonia Geranium

In general, the minimum light availability should be about 1000 lux for 12 hours per day to maintain plant quality in indoor plants.

Positioning / placement of indoor plants to suit light requirements

S.No.	Category	Suitable places
1.	Low	In northern exposures Several feet away from eastern exposures.
2.	Medium	Eastern exposures Within several feet of the light sources
3.	High	Near windows / glass doors with western / southern exposures
4.	Very high	In sunrooms / greenhouses

The amount of light at any given location will vary according to time of year (angle of the sun, day length), outdoor tree shading, window curtains and wall color (light reflection) as well as the location itself.

Artificial lighting

Artificial lighting is widely used to supplement or replace natural light. Many indoor plants grow well under artificial light provided by fluorescent lamps or special incandescent lights. A large variety of fluorescent lamps are available. Generally, ordinary incandescent lamps are not recommended for plants, as plants placed under them tend to stretch or become “leggy.” It is possible to make up for lack of sufficient light by increasing the time or duration that the plant is exposed to light. Sixteen hours of light and eight hours of darkness are satisfactory for most plants. An electric timer can be used to ensure the correct cycle each day.

Harms of inaccurate lighting of indoor plants

While lack of sufficient light results in poor plant growth, too much light can also be harmful. Shade plants cannot tolerate excessively high light levels. When a plant receives too much direct light the leaves bleach or scald, finally leading to death of the plant. This often happens after moving a plant outdoors in direct light. Any changes in light intensity should be gradual.

Light requirements of some common indoor plants

A. Low Light (1000 lux)

Botanical Name	Common Name
<i>Aglaonema commutatum</i>	Silver evergreen
<i>Aglaonema commutatum</i> cv. Silver King	Silver king evergreen
<i>Aglaonema modestum</i>	Chinese evergreen
<i>Aspidistra elatior</i>	Cast-iron plant
<i>Aspidistra elatior</i> cv. Variegata	Variegated cast-iron plant
<i>Chamaedorea elegans</i>	Parlour palm
<i>Epipremnum aureum</i>	Golden pothos

<i>Epipremnum aureum</i> cv. Marble Queen	Marble queen pothos
<i>Monstera deliciosa</i>	Split-leaf philodendron
<i>Sansevieria trifasciata</i>	Snake plant
<i>Sansevieria trifasciata</i> cv. <i>Laurentii</i>	Sansevieria

Medium light (1000 to 1500 lux)

Botanical Name	Common Name
<i>Aechmea fasciata</i>	Silver vase
<i>Asparagus densiflorus</i> cv. Myers	Plume asparagus
<i>Asparagus densiflorus</i> cv. Sprengeri	Sprengeri asparagus
<i>Asparagus setaceus</i>	Fern asparagus
<i>Aucuba japonica</i> cv. Variegata	Gold-dust plant
<i>Brassaia actinophylla</i>	Schefflera
<i>Brassaia arboricola</i>	Dwarf schefflera
<i>Caryota mitis</i>	Fishtail palm
<i>Chamaedorea erumpens</i>	Bamboo plant
<i>Chlorophytum comosum</i> cv. Variegatum	Spider plant
<i>Cissus rhombifolia</i>	Grape ivy
<i>Dieffenbachia amoena</i>	Giant dumbcane
<i>Dieffenbachia maculate</i>	Spotted dumbcane
<i>Dizygotheca elegantissima</i>	False aralia
<i>Dracaena deremensis</i> cv. Warneckii	Striped dracaena
<i>Dracaena fragrans</i> cv. Massangeana	Corn plant
<i>Dracaena godseffiana</i>	Gold-dust dracaena
<i>Dracaena marginata</i>	Red-margined dracaena
<i>Dracaena sanderana</i>	Ribbon plant
<i>Fatsia japonica</i>	Japanese fatsia
<i>Ficus benamina</i>	Weeping fig
<i>Ficus elastica</i> cv. Decora	India rubber plant
<i>Ficus lyrata</i>	Fiddle-leaf fig

<i>Ficus retusa</i>	Indian laurel
<i>Gynura aurantiaca</i>	Velvet plant
<i>Hedera helix and cultivars</i>	English ivy
<i>Howea forsterana</i>	Kentia palm
<i>Maranta leuconeura</i> cv. Erythroneura	Red-veined prayer plant
<i>Nephrolepis exatata</i> cv. Bostoniensis	Boston fern
<i>Peperomia caperata</i>	Emerald ripple peperomia
<i>Peperomia obtusifolia</i>	Oval-leaf peperomia
<i>Philodendron bipennifolium</i>	Fiddle-leaf philodendron
<i>Philodendron scandens</i> subsp. <i>oxycardium</i>	Heart-leaf philodendron
<i>Philodendron selloum</i>	Tree philodendron
<i>Pilea cadierei</i>	Aluminum plant
<i>Pilea involucrata</i>	Friendship plant
<i>Plectranthus australis</i>	Swedish ivy
<i>Polyscias balfouriana</i> cv. Marginata	Variegated aralia
<i>Saintpaulia</i> species, hybrids and cultivars	African violet
<i>Spathiphyllum</i> spp	Peace lily
<i>Syngonium podophyllum</i>	Syngonium
<i>Tradescantia fluminensis</i>	Inch plant
<i>Zebrina pendula</i>	Wandering jew

High light (1500 to 10000 lux)

Botanical Name	Common Name
<i>Aloe barbadensis</i>	Aloe vera
<i>Alternanthera ficoidea</i>	Joseph's coat
<i>Aphelandra squarrosa</i>	Zebra plant
<i>Araucaria heterophylla</i>	Norfolk island pine
<i>Beaucarnea recurvata</i>	Ponytail palm

<i>Cissus antarctica</i>	Kangaroo vine
<i>Citrofortunella mitis</i>	Calamondin orange
<i>Coffea arabica</i>	Coffee
<i>Coleus blumei</i>	Coleus
<i>Cordyline terminalis</i>	Ti plant
<i>Crassula argentea</i>	Jade plant
<i>Hibiscus rosa-sinensis</i>	Chinese hibiscus
<i>Hoya carnosa</i>	Wax plant
<i>Iresine lindenii</i>	Blood leaf iresine
<i>Podocarpus gracilior</i>	Weeping pododarpus
<i>Polyscias fruticosa</i>	Aralia
<i>Rhoeo spathacea</i>	Moses-in-the-cradle
<i>Schlumbergera</i> cv. <i>Bridgesii</i>	Christmas cactus
<i>Sedum morganianum</i>	Sedum

Humidity

Apart from shade, these plants also need high humidity in atmosphere. High humidity should not be confused with excessive watering of plants. Air in summer and monsoon season is normally more humid than in winter. Air conditioned places too are very dry and prevent healthy growth of shade loving plants.

To increase humidity around the plants, following things can be done.

- Keeping potted plants in bigger groups
- Providing water filled shallow and wide trays under the potted plants
- Spraying water on foliage frequently
- Keeping potted plants on moist ground

As the humid air is heavier than dry air, a humid micro-atmosphere is created around the plants by using the above methods - provided the fan or harsh breeze do not disturb this micro-atmosphere. Due to lack of humidity leaves of certain plants will bend downwards or may get brown dried edges.

Points to remember in indoor plant selection

1. Select plants with healthy foliage. Avoid plants which have yellow or chlorotic leaves, brown leaf margins, wilted foliage, spots or blotches, spindly growth, torn / damaged leaves.
2. Select only those plants which appear to be free of insects and diseases. Check the undersides of the foliage and the axils of leaves for signs of insects or disease.
3. Select plants that look sturdy, clean, well-potted and shapely.
4. Avoid plants treated with “leaf shines,” which add an unnatural polish to the leaves.
5. Plants which have new flowers and leaf buds along with young growth are usually of superior quality.
6. Select plants which require the same environmental conditions of the residential area.

Growing media

The potting soil, or media in which a plant grows, must be of good quality. It should be porous for root aeration and drainage, but also capable of water and nutrient retention. Most commercially prepared mixes contain no soil. High-quality artificial mixes generally contain slow-release fertilizers, which take care of a plant’s nutritional requirements for several months.

Most mixes contain a combination of organic matter, such as peat moss or ground pine bark, and an inorganic material, like washed sand, vermiculite, or perlite. Materials commonly used for indoor plants are the peat-lite mixtures, consisting of peat moss and either vermiculite or perlite.

Water management

The following are some important points to remember in water management of indoor plants.

Do’s

- Use your soil probe to check the soil before watering.

- Cover the soil surface evenly with water.
- Be sure to water near the edges of the grow pot.
- Pay attention to the light levels and air temperature that change with the seasons.

Don'ts

- Don't dump water in one spot; spread the water over the entire soil surface.
- Don't allow plants to sit in saucers of water for more than 30 minutes. After the root ball absorbs enough water to sustain the plant discard the remaining water

Nutrient management

Houseplants grown in low light conditions of the interior environment have reduced fertilizer requirements. Usually in the spring and summer when sunlight intensities increase and the days are warmer and longer, fertilizers are applied. During the short days of winter, many houseplants that receive little or no artificial light enter a 'resting stage', during which no fertilizers are required to be applied.

Frequency of fertilizer application

Frequency of fertilizer application varies with the vigour of growth and age of each plant. As a rule, fertilizer application should be more frequent when the plants are growing.

Fertilizer type

A complete fertilizer (one that contains nitrogen, phosphorous and potassium) is an excellent choice for indoor gardens. Choose a balanced fertilizer such as 20-20-20 for foliage plants, and one that is higher in phosphorous such as 15-30-15 for flowering plants,

Fertilizers for houseplants are available in liquid form, water-soluble granules and slow-release forms (granules, sticks or tablets). Water-soluble fertilizers are often preferred because dilute solutions reduce the possibility of fertilizer burn.

Soils that have a white film on the surface or pots with a white crust on the rim or drainage hole may indicate that the plant is being over-fertilized and/or possibly over-

watered. Salt buildup in the soil can lead to root damage, causing symptoms such as reduced growth, brown leaf tips, dropping of lower leaves and wilting of the plant. The most effective way to prevent salt injury is to prevent the salts from building up. This can be done by watering the soil thoroughly and allowing the excess to flow out of the drain holes into a tray.

General rules in nutrient management of indoor plants

- Feed houseplants every two weeks during the summer months with a half strength fertilizer mix.
- Houseplants require little or no fertilizer during the winter months.
- Slow-growing plants need comparatively less fertilizers and rapidly growing plants will need comparatively more fertilizers.
- Flowering plants usually require both more light and more fertilizer than foliage plants.
- Properly prepared potting composts contain enough food for about two months.
- Never fertilize diseased and stressed plants.

Methods of indoor gardening

The following are the methods of indoor gardening:

- Hanging baskets
- Window boxes
- Terrarium / bottle gardening
- Miniature gardening
- Vertical gardening for indoors
- Bonsai for indoors

Hanging baskets and window boxes

- Hanging baskets or window boxes full of flowers or foliage plants give a colour boost to the house and garden. They can be used effectively even in a very small space.
- By selecting plants carefully, they can be changed to suit every season.

- Site selection is important for baskets and boxes. Hang the basket so that it will be close to eye level so that it can be admired as well as watered easily. Window boxes should extend the entire width of the window for best appearance.
- A lightweight potting mix is needed for container gardening. Soil-less planting mixes provide excellent drainage, aeration and water-holding capacity that ordinary garden soil cannot supply.
- Drainage is essential so that the planting mix will not become water-logged.
- Plastic or wire baskets are ideal containers for hanging baskets and window boxes
- Liners are used in wire hanging baskets to hold the soil and plants in position. Liners can be made of dried sphagnum moss or coconut fiber known as coir.
- Small, healthy, young plants are selected since they adapt to new surroundings much faster than older plants.
- Plants with a variety of colours, shapes and textures are planted.
- Daily or even twice-daily watering may be necessary since containers can dry out very quickly.
- Frequent watering flushes nutrients from the soil quickly and hence frequent fertilizing is also necessary.

Terrariums

- A terrarium is a transparent glass or plastic container with soil on which plants are grown. It has an open or closed top and is used for displaying growing plants as a miniature landscape.
- Containers - Almost any type of clear glass or plastic container can be used for a terrarium: fish bowl, fish tank, glass jar, jug or bottle. There are also containers made especially for terrariums. The container must be clear to allow light.
- Containers can be closed or open. Plants in closed containers must be tolerant of high humidity. Containers with large openings without covers may be used but will require more frequent watering to maintain humidity.

- Plants – Low growing plants are best. Large plants can be used and kept small by pruning. Plants with variations in size, texture and color as well as adaptability are chosen.

Some foliage plants that do well in a small-mouthed terrarium:

- Creeping fig (*Ficus pumila*)
- Copper plant (*Cordyline terminalis*)
- Ribbon plant (*Dracaena sanderiana*)
- Earth star (*Cryptanthus acaulis*)
- Prayer plants (*Maranta* sp.)
- Parlour palm (*Chamaedorea elegans*)

- **Soil** - Soil must be high in organic matter, clean and well-drained. Since plants are not meant to grow rapidly, adding fertilizer is not necessary. Mixture of peat, pine bark and rich garden soil can be used. The soil must be sterilized. Relatively dry soil should be added to the container.
- **Location for the terrarium** - Most plants require light near a window or supplemental artificial light. The terrarium should be located within several feet of a bright window but not in direct sun.
- **Planting** - The container is sterilized before planting. In general, about a quarter of the container will be used for drainage material and soil. A layer of gravel is placed in the bottom of the container for drainage. Next, a ½-inch layer of charcoal is placed above the pebbles to keep the soil from developing a sour smell. Sphagnum moss may be placed over the charcoal to prevent soil from sifting into the drainage area.
- Plants should be arranged so that taller plants are towards the back. A low, coarse-textured plant makes a dominant focal point near the front. Sand, rocks, shells, wood and other natural materials can be used for visual interest. If the terrarium is to be viewed from all directions, the display should have a hill in the middle.
- It is very important when planting a terrarium that all plants be insects and disease free. Any Leaves that are yellow damaged or show any sign of disease or insect damage are removed.

- When placing plants in a deep container, or one with a small opening, long, slender tongs or a stick with a wire loop on the end must be used. A long stick with a cork fixed on the end can be used for firming the soil. Moss and other accessories may be added to give a finished appearance.
- **Care after planting**
 - Open terrariums need occasional watering.
 - Watering should always be light.
 - Heavy watering results water logging.
 - With a little trimming the overgrowing plants can be kept under control.
 - Frequent pinching of growing tips will result in more balanced growth.

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Lecture No.28

Lawn Grasses

A lawn can be defined as the green carpet for a landscape. It is an important feature for any type of garden. In a home garden a lawn improves the appearance of the house, enhances its beauty and increases conveniences and usefulness. The lawn provides a perfect setting for a flower bed, a border, a shrubbery, specimen tree or a shrub. Besides, the material value, a lawn has its spiritual value too. A lawn is the source of charm and pride and reduces tension of the mind after a day's hard work in the materialistic world.

The following table gives details of the common grass species used for lawn making.

S.No	Botanical Name	Common name	Texture	Suitable location
1	<i>Cynodon dactylon</i>	Hariyali (or) Doob grass	Medium	Suitable for open sunny locations; drought; tolerant
2	<i>Stenotaphrum secundatum</i>	St. Augustine grass	Coarse	Suitable for shady situations; requires frequent watering
3	<i>Sporobolus tremulus</i>	Chain grass	Fine	Suitable for saline soils and open sunny locations
4	<i>Poa pratensis</i>	Blue grass	Medium	Suitable for acid soils and suitable for higher elevations
5	<i>Pennisetum clandestinum</i>	Kikuyu grass	Rough	Grow well in acids soils, suitable for higher elevations.
6	<i>Zoysia japonica</i>	Japan grass	Coarse	Can grow well in poor sandy soil; open sunny situations
7	<i>Z. matrella</i>	Manila grass	Medium	Suitable for open sunny situations
8	<i>Z. tenuifolia</i>	Korean grass or velvet grass or carpet grass	Fine	Suitable for open sunny situations
9	<i>Cynodon</i> sp.	Bermuda grass	Fine	Suitable for open sunny

		(or) Hyderabad grass		situations
10	<i>Cynodon</i> sp.	Dwarf Bermuda	Medium	Suitable for open sunny situations
11	<i>Festuca</i> sp.	Fescue grass	Coarse	Shade tolerant, survive on inferior soils
12	<i>Paspalum vaginatum</i>	Paspalum grass	Medium	Suitable for open sunny situations

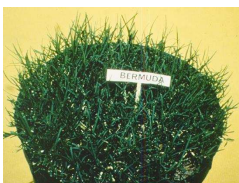
Based on climatic requirements, lawn grasses are classified as detailed below.

(a) Cool season grasses

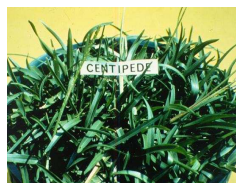
S.No.	Common Name	Botanical Name
1	Alkali grass	<i>Puccinellia distans</i>
2	Annual bluegrass	<i>Poa annua</i>
3	Canada bluegrass	<i>Poa compressa</i>
4	Chewing fescue / creeping red fescue	<i>Fescuta rubra</i>
5	Creeping bentgrass	<i>Agrostis palustris</i>
6	Colonial bentgrass	<i>Agrostis tenuis</i>
7	Crested wheatgrass	<i>Agropyron cristatum</i>
8	Ryegrass	<i>Lolium</i> sp.
9	Kentucky bluegrass	<i>Poa pratensis</i>
10	Red top	<i>Agrostis alba</i>
11	Timothy	<i>Phleum pratense</i>
12	Velvet bentgrass	<i>Agrostis canina</i>

(b) Warm season grasses

S.No.	Common Name	Botanical Name
1	Bahia grass	<i>Paspalum notatum</i>
2	Beach grasses	<i>Ammophila</i> sp.
3	Bermuda grass	<i>Cynodon dactylon</i>
4	Buffalo grass	<i>Buchloe dactyloides</i>
5	Carpet grass	<i>Axonopus affinis</i>
6	Centipede grass	<i>Eremochloa ophiuroides</i>
7	Grama grass	<i>Bouteloua</i> spp.
8	Japanese lawn grass	<i>Zoysia japonica</i>
9	Manila grass	<i>Zoysia matrella</i>
10	Orchard grass	<i>Dactylis glomerata</i>
11	Rhodes grass	<i>Chloris gayana</i>
12	Smooth brome grass	<i>Bromus inermis</i>
13	St. Augustine grass	<i>Stenotaphrum secundatum</i>



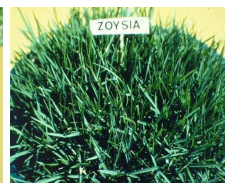
Bermuda grass



Centipede grass



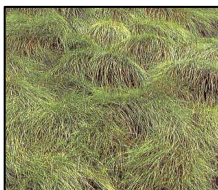
St. Augustine



Zoysia



Bahia



Creeping red fescue



Tall fescue



Creeping bent



Annual rye



Kentucky blue



Winter grass

Questions

1. ----- can be referred to as the green carpet for a landscape

Ans: Lawn

2. Name two grass species commonly used for lawn making.

Ans: *Cynodon dactylon*, *Zoysia japonica*

3. Name two grass species suitable for open sunny situation.

Ans: *Cynodon* sp., *Zoysia tenuifolia*

4. Name a cool season grass species

Ans: *Poa annua*

5. Give an example for a lawn grass for shady situations

Ans: *Stenotaphrum secundatum*

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Lecture No.29

Establishment and Maintenance of Lawns

The site

It is not always possible to get the best site one would like to choose for the lawn. But a few points should be kept in mind before selecting a site.



Soil

- In India, the common lawn grass, *Cynodon dactylon* (*Doob*), is very hardy and can be grown in any type of soil. But to obtain a most luxuriant lawn, it is desirable to have a fertile, loamy soil containing enough humus.
- The soil should retain enough moisture and at the same time the drainage should also be adequate.
- The ideal pH range is 5.5 to 6.0. If the pH is very low, about half a kilogram of chalk or grounded limestone should be added per square metre area on a sandy soil or a similar quantity of slaked lime should be added to clayey loam soil. In an alkaline soil, gypsum should be added at the same rate.
- At least a depth of 25-30 cm of good soil is required for obtaining a good lawn.

Drainage

- Grasses are shallow-rooted herbs and therefore, no deep drainage is necessary, but no water should stagnate in the rooting zone.
- In clayey soils, some kind of drainage must be provided. This may be done by drainage pipes or by putting a layer of broken pieces of bricks and gravel 90 cm below the surface.
- Ordinary drainage work can be carried out in conjunction with grading or leveling.

Digging

- Rough surface leveling by eye estimation should be done prior to digging. If during rough leveling a lot of shifting and filling of soil is necessitated, the surface soil should first be taken out and kept separately, which should be laid on the top after final leveling.
- After rough leveling is completed the digging work should be taken up. Thorough preparation of the ground is most essential in the success of a lawn.
- At each stage of digging care should be taken to see that the clods of earth are broken and pulverized thoroughly. During the process of digging, all stones, old masonry, grass roots, etc. should be removed.
- Special care should be taken to remove the roots of nut grass (*Cyperus rotundus*).
- In most parts of India, digging is done during the hot months of April and May. After the trenching is completed the soil is left to dry in the scorching sun for a period of 7-15 days to kill the weeds or insects and for sterilizing the soil.
- The soil should be turned up subsequently 2-3 times at weekly intervals, each time the clods of earth, if any, are broken and roots of weeds removed.

Manuring and grading

- After the digging is over, the soil is to be manured and graded (leveled).
- FYM or old stable manure is used for this purpose.

- The manure is sieved finely and spread over the surface at the rate of 500 kg per 100 square metres of soil. This is then worked up in the soil to a depth of 15-20 cm.
- The next step will be to settle the soil thoroughly. In heavy rainfall areas, the work is done by the pouring rains. In other areas, the prepared soil is watered heavily and check the run-off, bunds should be put up all along the periphery. The accumulation of water in pools will show the area of depression which should be smoothened by shifting soil from one place to another. The flooding should be repeated 2 or 3 times and between each watering the sprouted weeds should be removed.
- The final leveling is done with the help of leveling pegs, and spirit level. The soil is then lightly irrigated and the levels rechecked when the soil is sufficiently dried up.
- It is always advisable to keep the level of the lawn 5 cm below the levels of paths and drives, the margins along the paths are raised by gradual slope of 15-20 cm, to form a turf edge of 3-4 cm higher. This method will help keep the paths dry when the lawn is flooded with water.
- It is not always necessary to have a perfectly leveled lawn. Lawns can be laid in undulated land also and such lawns look very beautiful. But there should not be any depression as the water will collect and kill the *doob* grass. Moreover, the slopes and mounds in a lawn should be gradual and artistic, simulating the nature.

Selection of grass

- The most suitable grass for most parts of India is the *doob* grass or Bermuda grass (*Cynodon dactylon*). The grass thrives well under hot, sunny weather. This grass will not grow under shade. In Europe and America many grasses are used for the lawn, some of which may suit for our hill stations.
- *Poa* spp. (*Poa annua*, *P. pratensis*) is of a very fine texture and gives a soft carpet-like feeling when laid as lawn. The colour is blue-green. This is suitable for higher altitudes with cooler climatic conditions.

Method of planting

If irrigation facilities exist, a lawn can be laid out any time during the year. Under Indian climatic conditions it is better to sow after one or two monsoon showers, while the grass root is planted at the beginning of the monsoon. The different methods for starting a lawn are by (a) seed sowing (b) dibbling, (c) turfing, and (d) turf-plastering.

(a) From seed: If grass-cuttings or roots are not easily available, one should go for the seeds. It is important to secure good quality seeds free from weed seeds. *Doob* grass seed is very light and fine and proper care should be taken during sowing. Prior to sowing, the surface when relatively dried up, is scratched to a depth of 2.5 cm with the help of a garden rake. The total area should then be divided into equal plots of 200 to 300 square meters to ensure even sowing of seeds. The sowing should be preferably undertaken on a windless day. The seed is divided at the rate of 500 g per 200 square meters and mixed with double the quantity of finely sieved soil and broadcast by hand. After sowing is completed the rake is drawn lightly twice in opposite directions to mix up the seed. The ground should then be rolled with a very light roller. It will be advisable to cover the seeds with a thin layer of finely sieved soil. The plot should be watered at regular intervals with a water can having a fine hose. Watering can be done with a hose-pipe with a fine hose. Sometimes, ants carry away the seeds and to prevent this soil should be treated with an acaricide (Lindane, Chlorpyrifos, Heptachlor, etc.). The seed germinate in about 3 to 5 weeks from sowing. When the grass is about 5 cm tall it is clipped with a pair of garden shears. Initially the lawn mower is not used as this will uproot the grass. If the germination is patchy, re-sowing will be needed to cover such areas.

(b) Dibbling: After the land is ready, well-matured both unrooted and rooted *doob* grass cutting is obtained from a close-cut lawn or nursery or from a lawn-scraping. The roots or grass thus obtained are dibbled (planted) in the ground when it is slightly moist at 7-10 cm apart. The soil is kept moist by frequent watering till the grass sprouts. Roots of *doob* grass sprout easily and the cuttings or off-shoots root readily under moist condition

and within 5-7 weeks the grass will be ready for first cutting. By this method a lawn will be ready in about four months.

(c) Turfing: The quickest method of developing a lawn is by turfing, but the cost is prohibitive. Turf is a piece of earth of about 5 cm thickness with grass thickly grown over it. The pieces may be of small squares or in rolls small width (30 cm or so). The turf must be free from weed and consist of the required lawn grass. These should be laid closely to each other in a bonded alternate pattern, like bricks in a wall, in the already prepared ground. Any unevenness in thickness can be corrected by under packing or removing some of the soil before putting in position. Along the joints sandy soil should be filled as packing. Bone-meal is dusted in the prepared ground a few days prior to turfing. The turf thus laid is made firm by a wooden beater made out of heavy block of wood and fitted with a handle. The grass is immediately watered copiously. By this method a lawn will be ready for use in a very short time.

(d) Turf plastering: A paste is prepared by mixing garden soil, fresh cow dung and water. Bits of chopped-up fresh roots and stem or rhizomes of *doob* grass are mixed with this paste and the paste is spread evenly on the surface of the prepared ground after moistening the soil. The paste is then covered by spreading 2 cm of dry soil and watered at regular intervals. This method is not very suitable especially in a dry and variable climate.

Maintenance of lawn

Having raised a lawn by one of the methods described above, the question of maintenance comes next. If the lawn is not properly maintained, it will become useless within no time. The various aspects of maintenance are discussed below.

(a) Weeding: One of the main aspects of maintenance is the control of weeds. Without close attention or care a time will come when weeds will overcome the lawn grass, the soil will become sick. Weed is common in both new and old lawns. Therefore, as soon as a lawn is established weeding should start and continue at regular intervals or whenever the weeds come out. The frequency of weeding obviously will be more during the rains

than in the colder months. The *nut grass* (*Cyperus rotundus*) is the most difficult weed to eradicate, because of its deep root system. This should be removed with the roots as deep as possible with a long narrow-bladed (1-1.5 cm) *Khurpi*. All weeds should be removed with the roots and these should never be allowed to seed.

(b) Rolling, mowing and sweeping: The object of rolling is to help the grass anchor itself securely and also to keep the surface leveled. Rolling should be avoided when the soil is wet. Mowing is another important operation. The first thing is to obtain a good machine, which will cut evenly at a correct height. The frequency of mowing is determined by the amount of growth and will vary from season to season. But grass should not be allowed to grow more than 5-6 cm in length during any season.



Sweeping the lawn thoroughly after each mowing is essential to clean the cut grasses, which might have fallen from the mower box. Sweeping is also done every morning to clean the fallen leaves and other debris. Sweeping may have to be repeated two or three times in a day during the season when the deciduous trees shed their leaves.

(c) Irrigation: *Doob* grass is shallow-rooted and, therefore, frequent light irrigation is better than copious flooding after long intervals. Here again some people prefer flooding at long intervals as this saves labour. Labour as well as water can be saved to a considerable extent if sprinkler irrigation is used. The frequency of irrigation varies with the climate. Stagnation of water should not be allowed as it may kill the grass.

(d) Scraping and raking: Continuous rolling, treading, and mowing may result in the formation of a hard crust and the lower part of the lawn may get matted and woody. For

such lawns, the grass is scraped at the ground level with the help of a *khurpi* in the months of April and May. Scraping is followed by raking to break the crust. Where the condition of the lawn is good, hard and thorough raking is done both ways to loosen the old runners and to aerate the soil. Then the mower blade is lowered and the grass mowed close to the ground.

(e) Top dressing with compost and fertilizer

After scraping or raking, a compost consisting of good garden soil, coarse sand, and leaf-mould in the proportion of 1:2:1 (in sandy soil the proportion of sand should be reduced or eliminated altogether) is spread over the lawn to a depth of 3-5 cm. To cover to such a depth a 100 kg of compost per 100 square meters will be needed. Bone meal is also applied at the rate of 1 kg per 10 square meters. The same compost is used as top dressing again during September to October. From October to April, ammonium sulphate is applied once every month at the rate of 1 kg per 50 square meters area followed by watering. Application of fermented compost in liquid form is also very beneficial for lawns. This is prepared by fermenting 20 kg of compost in 100 litres of water for a few days. During fermentation, ammonium sulphate and super phosphate at the rate of 1 kg and 2 kg are added to this mixture. The concentrated mixture is strained through gunny cloth and diluted to tea colour and added to the lawn with water cans or by siphoning. After the application, the lawn is soaked with water. This can be applied twice a year (October and May-June). Raw cow dung may be fermented and used in the same way.

Problems in lawns

Frost-injury: In cold regions, the grass is injured due to frost. This can be avoided to a great extent if the grass is sprayed with water every evening and in the early morning after frost.

Thatching: Formation of straw like layers of dead stems, leaves and roots of grass is called thatching. It can be controlled by manual removal.

Yellowing: It is more prevalent in wet weather. It is controlled by drenching with copper oxychloride / Dithane M-45 @ 3g/litre or Bavistin 1g/litre

Earthworms: Affect lawn by depositing their excreta. Cause a circular ring of thin coloured or dead grass. They are controlled by drenching soil with Bavistin @ 1g/lit or Dithane M 45 @ 3g/lit. Oilcakes of neem / *Pongamia* @ 500g/10 m² may be applied before rainy season.

Termites: They are controlled by the application of Phoret / Thimet.

Questions

1. ----- is a hardy grass species which can be grown in all types of soil

Ans: *Cynodon dactylon*

2. Match the following

- | | |
|-----------------|-------------------------------|
| (a). June-grass | - <i>Cynodon dactylon</i> (b) |
| (b). Doob | - <i>Cyperus rotundus</i> (c) |
| (c). Motha | - <i>Poa pratensis</i> (a) |

4. The quickest method for establishing a lawn

- (a) Seed sowing (b) Dibbling, (c) Turfing, and (d) Turf plastering

Ans: (c) Turfing

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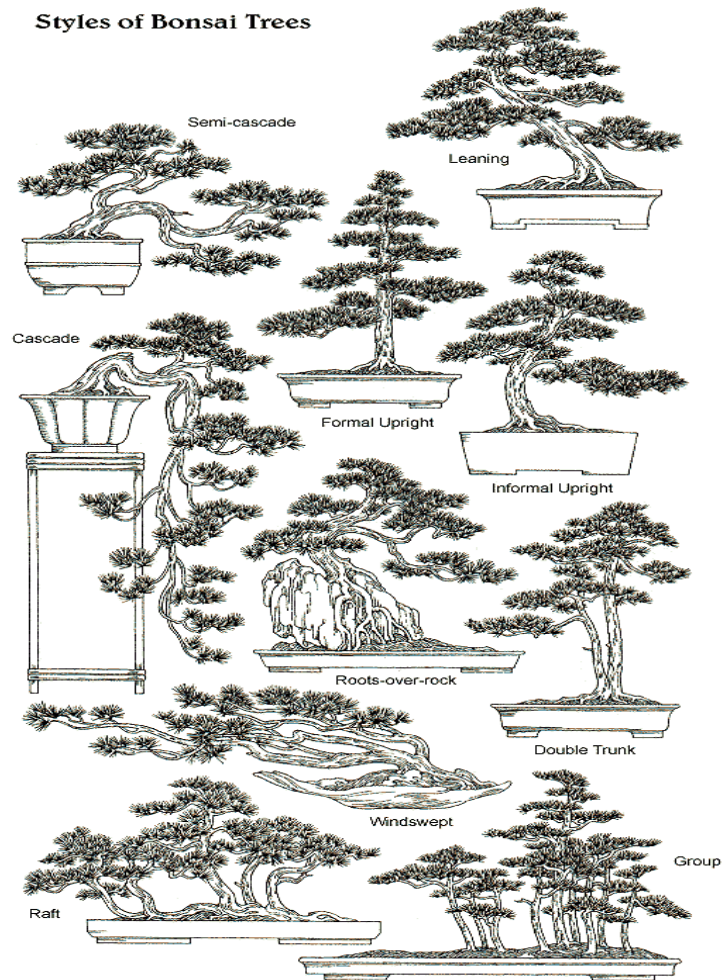
Lecture No.30

Bonsai - Styles, Plants and Containers

The word Bonsai is derived from Chinese Penjing and in Japanese ‘bon’ means, ‘shallow pot’ and the ‘sai’ means “plant” which is translated as ‘tray planting’. Bonsai is the art of growing trees, proportionately in small containers, occasionally in combination with rocks of many forms, by treating them with certain techniques in order to reproduce in miniature the lordly appearance of large and aged trees or landscape as found in nature.

In recent days, the demand for bonsais is growing rapidly in leaps and bounds and has attained the status of an exclusive sector in the landscape gardening industry.

Bonsai styles



There are many styles in bonsai, which have been developing over the ages. The following are the principal classical bonsai styles.

1. **Formal upright style (Chokkan):** In this style branches grow symmetrically and horizontally around the upright straight trunk.
2. **Winding or Kyokkum/Curved trunk style (Moyogi):** In this style plants retains a very natural appearance with the help of curving nature of the trunk. The branches get smaller in size towards the top growing also in the edge of the curves.
3. **Oblique/Leaning trunk style (Shakakn):** The trunk leans to one side, branches are positioned horizontally, shooting out in all directions. The surface roots clearly visible in the side opposite to the lean.
4. **Windswept style (Fukinagashi):** This differs from previous style that branches grow on one side of the trunk only. This gives the impression of the blowing continually from the direction.
5. **Broom style (Hokidachi):** This style having the similarity in appearance to unturned broom. It spreads the branches in the shape of a fan, may occupy half the total height of the tree. The trunk is upright.
6. **Cascade style (Kengai):** The branches grow out over the edge of the container choosed for this style is high enough to show off cascade effect to best advantage.
7. **Multiple trunks style or Clump shaped (Kadudaki):** Trunks are allowed to grow a single root, which has put several shoots. The result of this is a little group of trees. Generally, they should make up an odd number but if only trunks appear, they should of different sizes.
8. **Raft style (Ikuabuchi):** This style creates an effect of fallen trunk, which has put out roots downward, and branches upward. The final impression, which is quite original, is one of the groups of individual plants all spring from a horizontal trunk.
9. **Woodland (Yose ue):** In this fascinating style, in a single container a number of all individual plants of the same species are laid out in a correctly proportioned manner.
10. **Twisted trunk style:** The trunk diminishes size toward the top and gives the appearance of twisting in upon itself; the branches break out in all directions.
11. **On the rock:** The piece of rock is places appropriately in the container to be embraced eventually by the roots of the bonsai. This however sinks into the soil

below. Once the little tree starts growing and putting new roots in to small cavities in the rock, one can get so called “rock planting”.

12. **Memo bonsai/Mini bonsai/Disc bonsai:** The plants are often not more than 8 – 15cm high (3 – 6 inches) and grow in containers after no bigger than a thumble.

Characteristics of plants suitable for bonsai

The suitability of plants to develop a bonsai plant depends on various factors.

1. The plant should be hardy so that it can be grown in a small container for many years with all the manifestations of a living plant.
2. The trunk should develop a natural appearance.
3. The branches should grow in natural but artistic forms.
4. The growth of the plant and appearance should harmonious with the shape of the container.
5. The miniature plant showing seasonal variations in growth and flowering is a very interesting feature of bonsai.
6. Plants of low height and strong trunk, thick at the base are good as bonsai.

Pots or containers for bonsai

- The pots and containers used for bonsai vary in material, shape and size.
- Small ceramic or terracotta pots and containers of square, rectangular, oval or round shape are the best for bonsai.
- Sometimes small cement containers are also utilized for this purpose but these are not convenient to handle because of their heavy weight.
- The choice of the shape and colour of the container depends upon the style and the type of plant used for bonsai.
- Usually terracotta and light colours are preferable. The rectangular and oval shaped containers are ideal for most of the bonsai styles.
- The round or square container is suitable for growing a single plant in its centre unlike the other shapes in which the plant is placed on one side of the container.

Plants suitable for indoor bonsai

- *Ficus retusa* (Fig Tree)



- *Ligustrum nitida* (Chinese Privet)
- *Nandina domestica* (Sacred Bamboo)
- *Podocarpus chinese* Yew (Buddhist Pine)
- *Sageretia theezans* (Chinese Bird Plum)
- *Serissa foetida* (Tree of a Thousand Stars)
- *Ulmus parvifolia* (Chinese Elm)



Tropical plants

Members of the genus *Ficus* are among the most versatile, while many succulents can be grown in a similar fashion.



- ***Ficus benjamina*:** the Weeping fig is a popular indoor tree that lends itself to the classical, upright form. It is one of the few tropicals that are accepted as "true" bonsai. The miniature cultivars like 'Too Little' are well suited for bonsai. It forms aerial roots and can be shaped as a banyan tree. Ficus are intolerant to branch down-pruning; one must start with a small tree and keep it small. They are sensitive to stress.



- ***Ficus neriifolia* :** according to Jerry Meislik, "the most useful fig for bonsai is the willow leafed fig. The small leaf is in excellent scale for bonsai and the tree has good branch ramification, good basal rootage and excellent aerial root formation."



- ***Schefflera arboricola*:** the Hawaiian umbrella tree is a popular, hardy houseplant that is ideal for irregular, banyan or roots-on-rock forms. Since it can sprout on old wood, an old specimen can be pruned back to a

stockier shape with thick trunk and roots. It tolerates root exposure very well, is drought-resistant and requires a moderate amount of light. Under high humidity conditions, it produces aerial roots and can therefore be shaped as a banyan tree.



- ***Crassula ovata***: the jade plant is a very robust and drought-resistant house plant. The miniature cultivars like the baby jade plant (*C. ovata arborescens*) is considered the best plant for a first bonsai. This plant will sprout on old wood. Thus, an old specimen can be pruned back to a stockier shape with thick trunk. It is kept dry in winter, placed outdoors in summer for full growth. Its roots are thin and cannot be exposed.



- ***Portulacaria afra*** : the dwarf jade looks a lot like a baby jade plant and is used similarly.



- ***Dracaena marginata***: the dragon plant has an interesting palm-like shape. It can sprout on old wood. It does not tolerate root exposure.

- ***Schlumbergera***: the holiday cactus does not have a real trunk but easily lends itself to a cascade-type bonsai shape. It tolerates shade, not drought. Small succulents may be used as accent plants.
- *Rhipsalis (Hatiora) salicornioides*

Plants of other climatic origins

With proper care, a number of non-tropical plants can also thrive as indoor bonsai.

- ***Carmona microphylla***: the sturdy trunk and glossy green leaves of the Fukien Tea make an attractive indoor bonsai.

- **Boxwood:** found on nearly every continent, boxwood varieties are tough but attractive bonsai.
- **Serissa:** this is a delicate flowering plant with tiny leaves that can grow indoors year round.

Questions

1. Name two plants suitable for indoor bonsai

Ans: *Ficus retusa*, *Ligustrum nitida*

2. ----- is one of the few tropical trees that is accepted as "true" bonsai

a. *Ficus benjamina* b. *Dracaena marginata* c. *Ficus neriifolia* d. *Boxwood*

Ans: a. *Ficus benjamina*

3. In the 'broom' style of bonsai all the branches grow almost from the same place-
State. True / false.

Ans: True

4. Name two styles of bonsai

Ans: Formal upright, cascade

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Lecture No.31

Bonsai - Cultural Practices, Special Practices, Care and Maintenance

Source plants for bonsai making

1. **Cultivation from seed:** It takes long time, in the first place growing a house plant and then successfully shaping into perfect bonsai.
2. **Cultivation from vegetatively propagated plants:** This system is highly practical and commonly used. It is carried out by taking cutting from the matured shoots, layering, grafting and budding methods.
3. **Seedlings from local origin/countryside:** Seedlings of mature trees of local origin viz., gardens, terraces and fields along side of roads. For collection of these seedlings soil from the plants must be loosened using shovel, then only gently lift the plants without injuring the taproot. If the seedlings are to be planted immediately, simply cover the roots with loose and wet soil to prevent drying. If the planting delayed for few days, then cover the seedling with moist sphagnum moss or newspaper to keep the plants from drying out. After collection 2 – 3 year old seedling from the field, immerse the roots in a bucket of water or emulsion of clay and water.

Time of planting

- The bonsai plants are generally started in February-March or July-August.
- However, the best time to start it is before the new buds open.
- The temperate species like cherry, peach and plum are planted in spring (Feb-March) before the new leaves appear on the plant.
- Potting of bonsai should not be done in winter or in severe hot months.

Potting and repotting

- For starting a bonsai from the natural stunted plant or from a dwarf plant obtained from a nursery, it is necessary to prune the roots.
- Generally one-third of the roots is cut off and the tap root also may be pruned if there is an abundant growth of fibrous, lateral roots.

- The unnecessary branches are removed before planting.
- The basic principle in bonsai culture is to restrict and slow down the growth of the plant by selective pruning of roots and branches.
- However, at the same time, it is necessary to provide just adequate but balanced nutrition and regulated watering for proper and healthy but slow growth of the bonsai.
- Before potting the plant one must decide the style of bonsai to be followed.
- The method of planting in the pot or container and the training of the plant will depend upon the style of bonsai.
- The old bonsai requires repotting after 2 or 3 years depending upon the plant species and its growth. The repotting is done in the same way as the potting.

Training

- After planting, the plant is trained according to the style of bonsai.
- The branches or stem can be bent in the desired direction and form with the help of a copper wire which is removed once the required shape is formed.
- Sometimes polythene tape can also be used for the purpose.



Pruning and pinching

- The new growth is pinched once or twice and the branches are pruned sometimes to maintain the shape of the tree.

Planting medium

- Generally the planting medium in the pot or container consists of a mixture of two parts of loam soil, one part of fine leaf-mould and a little coarse sand.

- The medium for growing bonsai should be porous with a good drainage. Bone meal or superphosphate in small quantity is added to the planting medium.
- If possible, sterilize the medium with steam or chemical like formaldehyde.
- Often the soil in the pot is covered with moss and one or two small stones are placed to give a natural look.

Nutrition

- A mixture of NPK or liquid manure prepared with oilcake (neem or mustard) may be applied once a week after about a month of potting but not during the active growth or dormant stage of the plant.
- The application of bonemeal or superphosphate is useful in flowering while for fruiting add a little potash also to the potting medium.

Watering

- Regular and judicious watering is required but overwatering and water logging should be avoided.
- Watering is beneficial at the time of flowering but not in bougainvillea as frequent watering results in shedding of flowers.
- Conifers like pine and juniper require less water than other species.

After care

- The soil in the pot should be hoed lightly when it becomes hard.
- Frequent weeding, control of diseases and insect pests by pesticides, pinching and pruning whenever required, regular watering, balanced nutrition and providing adequate sunlight, are the necessary after-care of bonsai.
- Repotting of old bonsai after every 2-3 years is also helpful in proper maintenance of the bonsai.

Questions

1. -----is a propagation method for raising bonsai of bougainvillea

Ans: Layering

2. Root pruning is an important operation to restrict the growth in bonsai culture - State

True or False

Ans: True

3. The fruit plant widely used for bonsai culture is -----

Ans: Pomegranate

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Lecture No.32

Flower Arrangement - Principles

Flower arrangement is an art of arranging flowers in different styles.

Principles of flower arrangement

- Emphasis / Focal point
- Balance
- Scale / Proportion
- Rhythm
- Harmony and Unity

Emphasis / Focal point

- Central portion of arrangement from where flowers and foliage appear to be emerging.
- Larger and brighter flowers or flowers with unique shape are suitable as focal points.
- Focal point draws attention of viewer.
- One focal point is enough for a small arrangement while 3 or more focal points are important for a large one.

Balance

- A balanced arrangement has a distinct focal point.
- Balance may be symmetrical (geometrical) or asymmetrical.

Scale / Proportion

- Achieved by scaling the flowers from the focal point i.e. the smallest buds are placed farthest from the focal point.

Rhythm

- Rhythm is achieved through colour and gradation (size) of flowers
- The colour may be darkest at focal point and gradually lighter at the rims.

Harmony and Unity

- Blending of all the components is called harmony
- It is created when all the parts of the design blend together to form a single idea
- It is created by repetition of the components in the arrangements.

Elements of design

Line

- Visual path in the arrangement.
- Line may be created by repetition of similar flower colours, textures or shapes.



Courtesy: Dept. of Floriculture & Landscaping, TNAU, Coimbatore

Form

- Flower and foliage add a visual quality that is important in developing, harmony, creating rhythm and establishing focal point.



Courtesy: Dept. of Floriculture & Landscaping, TNAU, Coimbatore

Texture



Courtesy: Dept. of Floriculture & Landscaping, TNAU, Coimbatore

- It refers to the surface qualities of the plant materials.
- **Colour**



Courtesy: Dept. of Floriculture & Landscaping, TNAU, Coimbatore

- Colour combination should be pleasing.
- Primary colours : yellow, red and blue
- Secondary colours : orange, green, violet
- Tertiary colours : red, orange, blue-green

Container selection

- It is the foundation of a design.
- It should be suitable for flower arrangement.
- It should be capable of holding water.
- It should be stable enough to support the weight.

Selection of flowers and foliage

The shapes of flowers and foliages used by florists are classified into 4 groups.

Type	Description	Flowers	Foliage/Branch/Fruit
Line	Line flowers help to create outline of the design, i.e. the design skeleton or form. These are tall flowers that give height.	Gladiolus, tuberose, golden rod, heliconia, stocks, delphiniums	Twigs and branches of bottle brush, foliage of Sansievieria
Form	Form flowers help to create focal point	Anthurium, orchids, bird of paradise, heliconia, spathyphyllum, tulip, rose	Grapes, cashew fruit
Mass	Mass flowers have single stem with 2-3 small two	Rose, chrysanthemum, gerbera, anthurium,	Apple, pomegranate

	medium flowers at the top. These add depth to the arrangement	amaryllis, carnation, daisy, aster	
Filler	Add finishing touch	Button mums, gypsophilla, onion inflorescence, golden rod	Asparagus, Thuja, Casuarina, ferns, bottle brush

Questions

1. Name two principles of flower arrangement

Ans: Emphasis, Balance

2. ----- refers to the surface qualities of plant materials.

Ans: Texture

3. Primary colours are -----

Ans: Yellow, red and blue

4. Form flowers help to create -----

Ans: Focal point

5. ----- add finishing touch in flower arrangement

Ans: Fillers

6. Name two fillers used in flower arrangement

Ans: Asparagus, Thuja

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Lecture No.33

Flower Arrangement - Styles

Broad approaches in flower arrangement styles

- ❖ **Western style**
 - “Mass” effect
 - Arranging flowers in an even symmetry
- ❖ **Eastern style / Japanese style / Ikebana**
 - Less material
 - Specific rules and angles
- ❖ **Modern style**
 - Hybrid of above

Basic differences between Western and Eastern styles of flower arrangement

Parameters	Western style	Eastern style
Symmetry of arrangement	Symmetrical arrangement	Asymmetrical
Quantity of flowers / fillers	More flowers to create mass effect	Less flowers
Rim of vase	Plant materials may touch the rim of the vase	Never touch the rim of the vase
Accessories	Accessories never used	Branches, drift wood, pieces of bark, shells etc. are used

Ikebana

Definition / Concept

Ikebana is the Japanese art of flower arrangement

It's also known as the ‘Eastern style of flower arrangement’.

Ikebana is more than simply putting flowers in a container.

It is a disciplined art form in which the arrangement is a living thing in which nature and humanity are brought together.

Ikebana = Ike+bana; Ike = to live, bana = flower; it signifies life and freshness

History

Ikebana is an art with a recorded history.

It originated in the 6th century in Japan as a religious offering at Buddhist temples.

However history says that the actual origin of Ikebana is China from where it is believed to have spread to India and then Japan.

Ikebana is believed to have been introduced/ conceived by a Buddhist Monk 'Semmu'.

In Japan, Ikebana was popular among the aristocracy and the samurai class.

To reach a state of peace of mind and a state of concentration before going to battle, the samurai would perform both Ikebana and Tea Ceremony, which helped to purify their heart and mind.

By the 16th century, Ikebana had become a Zen practice.

Principles

Spiritual basis of Ikebana:

Ikebana involves spiritual significance

Closely associated to all aspects of life

It is associated with the philosophy of developing closeness with nature.

One becomes quiet when one practices Ikebana.

One becomes more patient and tolerant of differences, not only in nature, but also more generally in other people.

It helps to "live in the moment" and to appreciate things in nature that previously had seemed insignificant.

Rules of construction of Ikebana

Its materials are living branches, leaves, grasses, and blossoms, anything can be used and even a small weed can be given an important place in an arrangement.

Its heart is the beauty resulting from colour combinations, natural shapes, graceful lines, and the meaning latent in the total form of the arrangement.

The three main components of Ikebana: Heaven, Man and Earth.

In Ikebana empty space plays an essential part of the arrangement. The elements placed asymmetrically, are given emphasis by the spaces.

Thus, the totality of a well-done arrangement brings about a state of serenity and peace to the viewer.

Ikebana arrangement represents nature in the following way

- 1) A single flower symbolizes nature
- 2) Bamboo symbolizes integrity since it does not bend

3) Evergreen pine represents the abode of deity

Western flower arrangement

Basic principles

- Characterized by mass of flowers and foliage
- A balanced formal style which may be for front viewing or to be viewed from all sides.
- The flower arrangement can be a centre-piece on a table, placed on a window-sill, shelf, trolley, bookshelf or cupboard or may be hung on the wall

Types of Western floral arrangements

1. Circular
2. Triangular
3. Radiating
4. Crescent
5. Horizontal
6. Hogarthian curve

Circular arrangement

- Designed to be viewed from all sides and makes an excellent centre piece for low table.
- It lacks focal point.
- Containers - low round containers or baskets



Courtesy: Dept. of Floriculture & Landscaping,
TNAU, Coimbatore

Triangular arrangement



Courtesy: Dept. of Floriculture & Landscaping,
TNAU, Coimbatore

Height and width of the arrangement are important criteria.

Equilateral triangle-shaped arrangement - will be equally as tall as it will be wide.

The tallest flower is placed exactly in the centre of the container.

The two 'skeleton' flowers are then placed at each side at equal distance preferably.

A short-stemmed flower is placed at the front of the arrangement to form the focal point.

The triangular arrangement is completed by filling in with the remaining flowers and foliage.

Asymmetrical triangle - height and width of the arrangement will be altered.

Radiating arrangement



Courtesy: Dept. of Floriculture & Landscaping,
TNAU, Coimbatore

Has a fan-like outline.

Line flowers or foliages are used to form the outline - gladiolus, snapdragons, flat fern, and palm fronds are commonly used.

The height of the arrangement is established first.

The width of the design is determined by the placement of flowers at each side.

The fan shape is created by placing flowers or foliages to give the rounded appearance.

Crescent arrangement



Courtesy: Dept. of Floriculture &
Landscaping,

The overall outline is crescent / half-moon shaped.

The curved foliage is placed to the side (usually left of the centre).

The focal point is located directly beneath this point at the base of the arrangement.

The flowers used in this design will be smallest at the Points and largest at the center of interest of the arrangement.

Horizontal designs



Courtesy: Dept. of Floriculture & Landscaping,
TNAU, Coimbatore

The horizontal design makes an excellent centerpiece because it is beautiful when viewed from either the front or the back.

The height of the arrangement is reduced so that the horizontal length becomes $1\frac{1}{2}$ - 2 times the length of the container.

This gives the arrangement the appearance of being nearly like an inverted crescent design.

A focal point may then be established on each side to attract attention to the design.

This style of arrangement may easily be used with candles for an evening dinner party.

All foliage and flowers located near the candles should be low enough so they will not be burned as the candle is shortened by the flame.

Hogarthian curve

The Hogarthian curve is a sophisticated asymmetrical design.

It has the outline of an 'S'



Courtesy: Dept. of Floriculture & Landscaping,
TNAU, Coimbatore

Tall stemmed raised containers are used for this design, because a portion of the floral line extends below the rim of the container

The S shape is separated into two elements, with the upper curve consisting of two-thirds the height of the total design.

The focal point is often depicted by a cluster of grapes gracefully dangling over the rim of the container.

Questions

1. Eastern style of flower arrangement is symmetrical arrangement.

State true or false

Ans: False

3. ----- is the Japanese art of flower arrangement

Ans: Ikebana

4. The three main components of Ikebana are -----

Ans: Heaven, Man and Earth

5. Name two types of western floral arrangement

Ans: Circular, Crescent

6. ----- style has the outline of an 'S' in of flower arrangement

Ans: Hogarthian curve

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Lecture 34

VALUE ADDITION IN FLOWERS

(A) DRY FLOWERS

Definition : ‘Dry flowers’ refer to dried or dehydrated flowers or plant part or botanicals (roots, leaves, stem, bark or whole plant) that can be used for ornamental purposes. Dried flowers are also known as everlasting flowers or dehydrated flowers.

Economic importance: The dry flower industry is a Rs. 100 crore industry in India and such dry decorative materials are globally accepted as natural, eco-friendly, long lasting and inexpensive. India is one of the major exporters of dried flowers to the tune of 5% world trade in dry flowers. This industry is growing at 15% annual growth rate. Potpourris is a major segment of dry flower industry valued Rs. 55 crores in India alone. Easy and year-round availability of a wide range of raw materials from forests and availability of manpower for labour intensive craft making are the reasons for development of dry flower industry in India. This industry provides direct employment to around 15,000 people and indirect employment to around 60,000 people.



Indian states with potentials for dry flower industry: At present India is a leading exporter of dry flower to the world market. The major importers of the country's dry flower products are Western Europe, United States, Japan, Singapore and Hong Kong. West Bengal and Tamil Nadu are the two major states where the Industry has steadily growing up. The rich biodiversity of these states in terms of topography and climate has made them a rich source of plant materials for the dried flower Industry.

Product segmentation

The Indian dried flower export market is classified into four main product segments as detailed below.

1. Dried flowers and plant parts in bulk.
2. Potpourri
3. Arrangements
4. Floral handicrafts

Tips for collecting plant materials for dry flower making

- Avoid collecting plants when they are wet or moist from dew.
- Use a sharp knife or pruning shears to cut flowers and plant materials.
- Select plant materials that are without insect or disease problems.
- Place stems in water while harvesting to prevent wilting. Some flowers may hold color better if allowed to stand in water for a few hours. Start the drying process as soon as possible after cutting.
- Collect more plant materials than needed to allow for some loss.
- Be mindful of where you collect plant materials; never remove unlawful or endangered plants.

Stage of picking for dry flower making

Flowers to pick when fully opened:

- Delphinium (spike should be half open, half in bud)
- Golden rod
- Peony
- Safflower
- Strawflowers

Flowers to pick when fairly opened:

- Celosia (before seeds appear)
- Marigold
- Salvia

Flowers to leave on stalk until very dry:

- Globe amaranth
- Pansy
- Yarrow

Other plants suitable for dry flower making:

- Artemisia
- Gypsophila
- Carnations
- Cock's comb
- Cornflower
- Daffodils
- Statice
- Herbs (bay, sage, marjoram)
- Hydrangea
- Lavender
- Verbena
- Grasses
- Peony
- Rose
- Sunflower

Processes in dry flower making

(1) Drying

Since flowers and foliage consists of more water, dehydration is necessary for getting dry flowers. Methods used for removing water from plant parts are Air-drying, Sun drying, Oven drying, Embedding (sand, borax, silica gel and combination of these materials), Glycerining (Glycerinating), Microwave oven drying, Freeze-drying and Press drying.

i. Air drying

Tie the flowers in loose bunches and hang upside down until they are dry in a room with good ventilation and darkness. It is the ideal method for seedpods, grasses and many flowers having more cellulose material. Crisp textured flowers like Helipterum, Helichrysum and Limonium could easily be dried either by hanging or positioning them erect in containers for 1-2 weeks. Gomphrena flowers from half to full bloom maturity take 7-9 days for air drying and roses take 5-10 days.

Acacia, amaranths, castor flowers, citrus leaves, cockscomb, corn flower, fennel, fern, golden rod, gypsophila, grasses, herbs, ear heads of wheat, oat and rye, hydrangea, lavender, protea, marigold, poppy seed pods, physalis, peppers, roses, statice, thistle, yarrow and yucca can be dried by this method.

ii. Sun drying

Plant material is embedded in drying medium (sand) in a container and exposed to the sun daily to facilitate rapid dehydration. In India, open sun drying is followed for drying many flowers. Flowers like small zinnias, marigolds, pansies, and pompon chrysanthemum embedded in sand upside down fashion and kept in the Sun would dry in a day or two. For Gomphrena, Zinnia and French marigold it would take 3-4 days. Open sun drying is followed for corn flowers, custard apple (small), Casuarina pods, mini coconut, eucalyptus, evergreen cones, gomphrena, gourds, pomegranates, poppy pods, lotus pods, typha heads, palm leaves, grass ear heads.

iii. Oven drying

Electrically operated hot air oven at a controlled temperature of 40-50 °C is used for drying flowers in an embedded condition. Chrysanthemum, dombeya, gerbera, and limonium take 48 hours at 45-49 °C, French marigold takes 72 hours, African marigold takes 96 hours and Nymphaea takes 120 hours for drying. China aster, delphinium, rose buds and small flowers, and zinnia take 48 hours at 40 - 44 °C, medium and large roses take 72 hours and very large flowers take 96 hours in 40 - 44 °C.

iv. Embedding method

Embedding the flowers in a granular, desiccating material is probably the most commonly used method and many consider it the best all around method. Several materials may be used, and they vary in cost and the results that they produce. To cover a flower, put about an inch of desiccating material at the bottom of the container; cut the flower stem to about a half an inch and stick this into the center of the material at the bottom to hold the flower. Next, pour the desiccating material along the perimeter of the container, away from the flower, building up a continuous mound of about an inch. Then tap lightly on the container and the material will move to the flower, not altering the form of the petals.

Continue adding the material, tapping on the container, etc. until the flower is completely covered. Lastly, add an inch of the material above the top of the flower.

Sand, borax, silica gel, saw dust, perlite and combination of these materials are used in this method. Sand and Borax methods though relatively cheap, take longer time and labour for drying. Silica gel is the ideal drying agent for delicate flowers such as roses, carnation, dahlia etc. It takes less time and can be reused indefinitely after removal of moisture from the silica gel crystals by drying them in an oven at 250 °F for 1 hour.

French marigold and zinnia (half to full bloom stage) take 4 days for drying by silica gel embedding. Wiring of flowers before drying is essential for which 20-24 gauge florist wire is used. Chrysanthemum takes 5 days for drying in silica gel.

Ageratum, anemone, amaryllis, bleeding heart, baby's breath, bachelors button, chrysanthemum, calendula, clematis, crocus, daffodil, dahlia, daisy, delphinium, gloriosa lily, gaillardia, geranium, gladiolus, hyacinth, hibiscus, lily, marigold, pansy, petunia, poinsettia, poppy, rose, salvia, snap dragon, stock, tulip, verbena and zinnia are the flowers suitable for embedding method of drying.

v. Microwave oven drying

Electronically produced microwaves liberate moisture from organic substances by agitating the water molecule. It is fast and the results are good. The flowers has to be embedded in silica gel medium in a microwave safe open container along with a small cup with water nearby. Standing time of 10 minutes to few hours is needed after the drying for best results.

vi. Glycerin drying (glycerinization)

‘Glycerinizing’ is the term used in the ornamental cut flowers and foliage industry to describe the treatment of fresh plant materials with a hygroscopic (water attracting) chemical with the objective of retaining the suppleness of the plant materials. Foliage treated with glycerin keeps almost indefinitely and remains pliable. Glycerin preserves foliage by replacing the natural moisture present in the leaf with a substance that maintains the leaf form, texture and sometimes the colour. Fresh and fairly matured foliage is ideal for glycerinizing. About 50 per cent of most plant fresh weight is water, but brittleness is usually only a problem if the water content falls below 10 per cent.

vii. Freeze drying

Freeze dried flowers are fresh flowers that have been specially dried to preserve their natural shape, colour and beauty. Freeze drying is accomplished by a process called sublimation. It requires a special freeze-drying machine. It involves first freezing the flowers at (-) 10 °C for at least 12 hours. A vacuum pump slowly pulls the water out of the flowers as a vapor in one chamber, and then the vapor condenses as ice in another chamber. Because of this process, the shape and natural color of the flower is maintained. For Roses it takes 15 – 17 days and for other flowers normally 10 – 12 days. Major flowers dried by this method are roses, carnation, bridal bouquets etc.

Flowers recommended for freeze drying

Alstoermeria	Gladiolus
Amaranthus	Gypsophilia
Aster	Hyacinth
Astilbe	Hydrangea
Calla Lily	Iris
Carnation	Liatris
Cattleya Orchid	Lilac
Daffodil	Lily
Dahlia	Lily of the Valley
Delphinium	Lisianthus
Dendrobium orchid	Peony
Dianthus	Phaleonopsis orchid
Feverfew	Rose (all varieties)
Freesia	Snap dragon
Gardenia	Statice

viii. Press drying

Flowers and foliage are placed in-between two folds of newspaper sheets or blotting paper and these sheets are kept one over other and corrugated boards of the same size are placed in-



between the folded sheets so as to allow the water vapour to escape. The whole bundle is then placed in the plant press, its screws tightened. After 24 hours the bundle is removed to an electric hot air oven for 24 hours at 40-45 °C. The following flowers and foliage are dried by this method. Flowers: Candytuft, Chrysanthemum, Euphorbia, Lantana, Larkspur, Mussaenda, Pansy, Pentas, Rose and Verbena, and Foliage: Thuja, Taxodium, Marigold, Grevillea, Rose, Ferns, Casuarina, Silver oak and Grasses.

(2) Bleaching

Bleached ornamental plant material provides a striking contrast when arranged with dried or dyed flowers. Bleaching also allows the use of dyes for colouring. Oxidative (Hypochlorite, Chlorite and Peroxide) and reductive bleaching chemicals (Sulphite and Borohydride) are used for bleaching ornamental flowers and foliage. Profitability is depended upon attainment of high white quality and on cost efficient utilization of expensive bleaching chemicals. Sodium Chlorite is an excellent bleaching agent because it is relatively selective for lignin without damaging fibre. Optimum pH (4.5-3.5) and temperature (70 °C) is to be maintained for effective chlorite action. Hydrogen Peroxide may be more practical for some plant materials because it is less expensive.

Sodium Chlorite 10 % solution at 70 °C is ideal for complete colour removal of pink Gomphrena flowers in to pure white flowers at 7 hours of immersion. Hydrogen peroxide 30% also takes 7 hours for complete colour removal of Gomphrena.

(3) Dyeing

Though preserving flowers with their natural colour is more appealing, some plant parts need artificial dyeing to improve the colour. Systemic dyes are available for use. They are acidic-anionic dyes, which are combined with water and glycerin to form a preservation solution that is absorbed by fresh cut flowers and foliage through the stem of the plant. As the water evaporates, it leaves behind the dye and glycerin for our desired colour. Normally 1.5 ml to 5 ml dye/l of solution is prepared. Colour take and preservation will take 2-8 days.

(B) FLORAL PATTERN / FLOWER RANGOLI

Floral pattern or ‘rangoli’ with flowers is a common practice in India. Generally, the petals of different flowers are taken out and are arranged in various patterns. Intact flowers of small-flowered chrysanthemums and other flowers can also be used for this purpose.



A flower rangoli

(C) BOUQUETS

A flower bouquet is a collection of flowers in a creative arrangement. Flower bouquets are often given for special occasions such as birthdays or anniversaries. They are also used extensively in weddings. Traditionally the bride will hold the bouquet, and the Maid of Honor will hold it during the ceremony. A wedding bouquet of flowers or roses is an idea that was brought up years ago and then became a tradition



Materials for bouquet making

1. Bouquet wrapper
2. Ribbon bouquet wrap
3. Holder
4. Bouquet Handle Sleeves
5. Bouquet Collar

Flowers for bouquets

Different flowers suit different occasions.

Type of occasion	Suitable flowers for bouquet making
Elegant	Lilium (white)
Informal	Daisy (white petals with yellow centres)
Traditional	Rose (varying colours)
Unique	Sunflower
Simple	Tulips and Gypsophila

Line flowers

Line flowers are tall, and give your bouquet height, width, and a balanced look. Branches and tall foliage can serve as line flowers. Most line flowers have buds growing up a center stalk. Examples of line flowers are gladiolus, liatris, snapdragon, delphinium, tuberose, veronica, curly willow, bells-of-Ireland and stock.

Mass flowers

Mass flowers will give the bouquet weight or mass and are generally round and full faced. Sometimes they are referred to as face flowers. They are usually the focal point of color and interest in a bouquet. Most mass flowers come with only one flower on the end of the stem. Examples of mass flowers are rose, carnation, gerbera, sunflower, lily, daffodil, tulip, iris, freesia, zinnia, alstroemeria, protea, chrysanthemum.

Fillers for bouquets

- Grasses
- Eucalyptus
- Ferns
- Asparagus
- Gypsophila

Types of bouquets

Generally bouquets are a circular in shape with the flowers tied together in a specific structure. In recent days, various styles of bouquets have become popular. Some types are described below.

Posy: A posy is a round bouquet. The stems may be removed and wired or left as it is. The posy is round and small and can easily be held in one hand.

Crescent bouquet: A crescent bouquet can be symmetrical or asymmetrical. Both left and right side of the bouquet is seen to be flowing down. A symmetrical crescent bouquet has flowers and greenery arched at same lengths on both sides, whereas the asymmetrical, has one side longer.

Arm bouquet: The arm bouquet is also referred to as presentation bouquet or pageant bouquet. Flowers suitable for this bridal bouquet type often have long stems, like calla lilies, orchids and also long-stemmed roses. The flowers are left at its natural state, with a big ribbon tied to bundle them together. Popular floral choices for arm bouquets are calla lilies, gladiolus, orchids, long-stemmed roses, delphiniums, and larkspur.

Freeform/Contemporary bouquet: A freeform bouquet does not have a specific or defined shape. In fact, most freeform bouquet has foliage coming out of the bouquet. Tropical flowers are usually used for this type of wedding bouquet. Uniquely shaped flowers are often used. It is popularly used for elegant or contemporary style weddings.

Single stem bouquet: A single stem bouquet is for someone who loves simplicity. This bridal bouquet type often has its flower stem wrapped or a big ribbon tied to it to add more attention.

Pomander: A pomander is a ball of flowers carried by a ribbon attach to it.

Cascade bouquet: Also called a fountain or waterfall bouquet, this has an abundance of blossoms at the top of the bouquet then tapers downwards with flowing foliage or ribbons at the bottom.

Fan: This is simply a bouquet of flowers attached to a plastic fan. Popular in the late eighties, they were embellished with carnations, baby's breath and plenty of ribbon.

Hand-tied bouquet: Hand-tied bouquets give off a casual feel. A grouping of flowers tied together with ribbon. It looks as if they were picked fresh right out of the garden. This is perfect for casual or garden weddings.

Oval bouquet: This bouquet is a combination of both a cascade and a round. Generally the bottom is narrower than the top, but the overall shape resembles an oval. This can be used in almost any style wedding.

Heart bouquet:

A romantic, shaped bouquet featuring two full arched shapes at the top while tapering down to a point at the bottom of the bouquet. Typically the traditional shape, often seen at Valentine's Day, symbolizing love and romance.



Mixed flower bouquets: These can be made the same way as the rose bouquet. Substitute smaller flowers for the rosebuds, and use larger flowers towards the center of the bouquet.

Fruit bouquet: A fruit bouquet is a fruit arrangement in the form of bouquet. The fruit is cut in the shape of flowers and leaves and are arranged in the container with the help of sticks. A complete arrangement looks like a bouquet of flowers. Fruit bouquets generally have seasonal themes, such as Christmas, graduation, birthday, anniversary, housewarming and Valentine's Day.

Questions

1. Stage of picking of flowers for dry flower making in golden rod is -----

Ans: Fully opened stage

2. -----is the ideal method for drying of seedpods.

Ans: Air drying

3. ----- is the ideal drying agent for delicate flowers such as roses, carnations and dahlias.

Ans: Silica gel

4. Freeze drying is accomplished by a process called -----.

Ans: Sublimation

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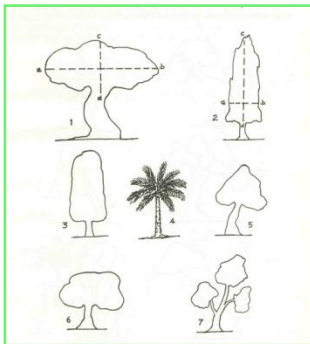
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EXERCISE NO. 1

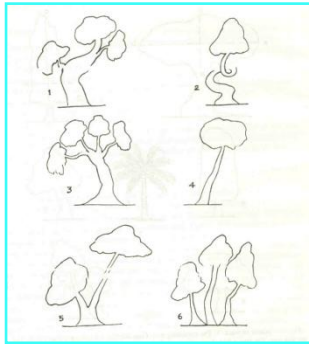
IDENTIFICATION AND DESCRIPTION OF TREES AND SHRUBS

Significance of trees in landscaping:

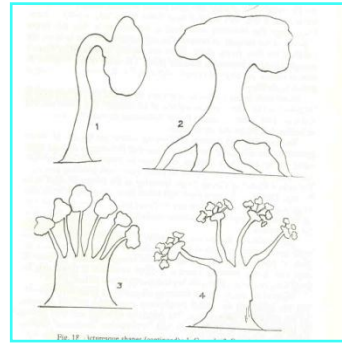
- Trees form the main framework of the garden.
- Some trees produce attractive and beautiful flowers including fragrant flowers
- Some trees are noted for their attractive foliage
- Some trees are known for their peculiar shape or form which is used as specimen trees



1. Spreading tree
2. Upright tree
3. Columnar tree
4. Umbrella shape - palm
5. Conical tree
6. Round-headed tree
7. Picturesque tree



1. S-shaped tree
2. Twisted trunk
3. Buttressed tree
4. Slanting tree
5. Twin-branched tree
6. Three-trunk tree



1. Cascade
2. Exposed root
3. Coppiced tree
4. Lopped tree

- Shady trees are planted in chosen spots of large public gardens which provides place for picnic and relaxation. Such trees are also planted along the borders of roads as avenue for giving shade.

Selected list of ornamental trees:

(A) Flowering trees

Botanical name	Common name	Family	Flowering season	Flower colour	Remarks
<i>Albizzia lebbek</i>	Albizzia	Leguminosae	April-May	Greenish white, heavy fragrance	Attractive foliage 16-20 cm long pods
<i>Bauhinia purpurea</i>	Mountain ebony	Leguminosae	October-March	Large flowers, rose and purple tones	10-12 m height, hardy tree
<i>Bauhinia variegata</i>	Bauhinia	Leguminosae	February - March	Large, fragrant coloured with various shades of pink and purple	6-8 m height, flowers appear when the tree is leafless
<i>Bixa orellana</i>	Annatto	Bixaceae	September	Petals white and pale pink	Dye is prepared from orange red pulp that covers the seeds
<i>Bombax malabaricum</i>	Red silk cotton	Bombacaceae	January -	Bright red	Tall, quick growing, flowers

			February		fleshy and edible
<i>Butea monosperma</i>	Flame of the Forest	Leguminosae	February - March	Orange red	Flowers used as dyes, gum is used for tanning
<i>Caesalpinia coriaria</i>	Divi-Divi	Leguminosae	April-July	Greenish yellow flowers, scented	Slow growing
<i>Callistemon lanceolatus</i>	Bottle brush	Myrtaceae	Throughout the year, peak in February - November	Scarlet red	Drooping / pendulous growth habit, flower bearing branches resemble bottle brush in shape
<i>Calophyllum inophyllum</i>	Alexandrian laurel	Guttiferae	June - November	Fragrant white	Medium sized tree, 15 m height
<i>Cassia fistula</i>	Golden shower	Leguminosae	February - May	Yellow	Medium sized tree
<i>Cassia javanica</i> subsp. <i>renigera</i>	Burmese pink cassia	Leguminosae	April-July	Bright pink, fading to white	Deciduous tree, 12-16 m height
<i>Cassia siamea</i>	Kassod tree	Leguminosae	June-January; peak in October	Bright yellow	Rounded crown, suitable for road sides, avenues and parks

<i>Cordia sebestina</i>	Scarlet cordia	Boraginaceae	Year round flowering; peak - January - May	Scarlet red	Dwarf evergreen, 6-8 m height
<i>Couropita guianensis</i>	Cannon ball tree	Lecythidaceae	-	Fragrant showy flowers	Tall soft wooded deciduous tree, 15-20 m, large spreading crown
<i>Crescentia cujete</i>	Beggar's bowl	Bignoniaceae	April-June	Pale greenish yellow	Handsome tree, flowers appear on main trunk and old branches
<i>Delonix regia</i>	Gulmohar / mayflower	Leguminosae	March-July	Scarlet, mild scent	Large deciduous tree, umbrella shaped crown, 12-20 m height
<i>Grevillea robusta</i>	Silver oak	Proteaceae	March-April	Small reddish orange	Medium sized tree (25 m), attractive foliage
<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	March-April	Purplish blue	Medium sized (10-12 m), subtropical
<i>Kigelia pinnata</i>	Sausage tree	Bignoniaceae	-	Striped on the outside	Large spreading crown well shaped tree, fast growing, hardy, flowers hang on a rope like stalk arising from the branch which

					may attain a length of 1.5-2m.
<i>Lagerstroemia speciosa</i>	Pride of India	Lythraceae	February-April	Purplish-pink flowers, terminal panicles	6-8 m, uniformly spreading,
<i>Michelia champaca</i>	Champaka	Magnoliaceae	Throughout summer and rains	Yellow scented	Medium sized (20 m), cylindrical crown
<i>Milingtonia hortensis</i>	Tree jasmine / Indian oak tree	Bignoniaceae	-	White and fragrant flowers open in the evening	Tall evergreen, 15-20 m height, drooping branchlets, bark irregularly ridged and fissured, very rough and corky, avenue planting
<i>Peltophorum pterocarpum</i> <i>Syn : P. ferrugineum)</i>	Rusty shield bearer / Copper pod bearer / yellow gulmochar	Leguminosae	March-April, minor flushes in rainy season	Yellow	Large tree (30 m), spreading crown, road side planting
<i>Plumeria</i> spp. (<i>P. alba</i> - white; <i>P. rubra</i> - rose, pink, red)	Pagoda tree / Temple tree	Apocynaceae	Summer; <i>P. alba</i> - throughout year	Large flowers, white or various shades of pink, yellow and red	Medium sized deciduous tree

<i>Pongamia glabra</i>	Pongamia	Leguminosae	May-June	Lilac coloured or pale pink	Moderate sized tree, 10-15 m, shining dark green leaves
<i>Samanea saman</i>	Rain tree	Leguminosae	March- October, peak - March-April, Sept. - October	Rosy pink with attractive rosy stamens projecting far beyond the rest of the flower	Large tree, 20 m height
<i>Saraca india</i>	Asoka tree	Leguminosae	February	Yellow or orange	Medium sized (8-10 m), shade tree, associated with Lord Buddha
<i>Spathodea campanulata</i>	Tulip tree	Bignoniaceae	February	Large, scarlet red flowers	20 m height, drier soil and climate
<i>Tabebuia rosea</i>	Rosy trumpet tree	Bignoniaceae	February	Rose purple flowers on leaf less clusters	20-25 m, quick growing, but not wind tolerant

(B) Trees with attractive foliage / canopy

Botanical name	Common name	Family	Remarks
<i>Albizia lebbek</i>	Albizia	Leguminosae	Attractive foliage 16-20 cm long pods
<i>Aleurites fordii</i>	Indian walnut / Tung oil tree	Euphorbiaceae	Evergreen, medium height 15m; hairy, triangular leaves, edible oil from seeds, oil has medicinal uses
<i>Azadirachta indica</i>	Neem	Meliaceae	10-15m height
<i>Bombax malabaricum</i>	Red silk cotton	Bombacaceae	Tall, quick growing, flowers fleshy and edible
<i>Caesalpinia coriaria</i>	Divi-Divi	Leguminosae	Slow growing
<i>Calophyllum inophyllum</i>	Alexandrian laurel	Guttiferae	Medium sized tree, 15 m height
<i>Eucalyptus citriodora</i>	Eucalyptus	Myrtaceae	Tree of elegant appearance, 40-50 m height
<i>Ficus bengalensis</i>	Ficus	Moraceae	Large, 30 m tall, horizontal spreading
<i>Ficus elastica</i>	Rubber tree	Moraceae	Large tree, small plants are used as houseplants
<i>Filicium decipiens</i>	Fern leaf tree	Sapinadaceae	Medium sized tree, attractive foliage, best in humid and semi shaded conditions.

<i>Grevillea robusta</i>	Silver oak	Proteaceae	Medium sized tree (25 m), attractive foliage
<i>Polyalthia longifolia</i>	Mast tree	Annonaceae	Tall, upright (20-25 m), conical shape, branches and leaves droop steeply downward
<i>Pongamia glabra</i>	Pongamia	Leguminosae	Moderate sized tree, 10-15 m, shining dark green leaves
<i>Pterospermum acerifolium</i>	Pterospermum	Sterculiaceae	Large handsome tree
<i>Samania saman</i>	Rain tree	Leguminosae	Large tree, 20 m height
<i>Saraca indica</i>	Asoka tree	Leguminosae	Medium sized (8-10 m), shade tree, associated with Lord Buddha
<i>Simarouba glauca</i>	Paradise tree	Simaroubaceae	Medium tree, 15m height, glossy attractive foliage, fast growing
<i>Terminalia arjuna</i>	Terminalia	Combretaceae	Horizontal spreading tree, Commonly planted along road sides
<i>Terminalia. catappa</i>	Indian almond / Country almond / Tropical almond	Combretaceae	Tall deciduous, 25 m height, branches horizontally spreading in whorls from main stem, leaves large, clustered, showy green; one of the few tropical species changing leaf colour to red purple before fall

SHRUBS

- A stretch of shrubs are established as borders on the sides of walks and paths.
- Shrubs are planted at the corners of lawns
- A shrubbery is an area planted with different kinds of shrubs
- A shrub border is made with only one kind of shrub
- Shrubs that stand frequent pruning and trimming can be used for topiary work.
- Tall growing shrubs can be used to screen disagreeable objects.

Selected list of shrubs

Botanical name	Common name	Family	Propagation	Remarks
<i>Acalypha indica</i>	Acalypha	Euphorbiaceae	Cuttings	<ul style="list-style-type: none"> • Suitable for hedging and screening • Leaves are blotched, mottled with different shades of red, crimson and brown • Flowers bright red in drooping spikes • Hedge – screens. Best in full sun
<i>Acalypha hispida</i>	Cat's tail	Euphorbiaceae	Cuttings	<ul style="list-style-type: none"> • Green leaves, hairy on top, slightly pale beneath
<i>Adenium obesum</i>	Desert rose	Apocynaceae	Cuttings	<ul style="list-style-type: none"> • Unique plant with swollen stem appearing like a bonsai

				<ul style="list-style-type: none"> • A wide range of flower colour – pink, white, red, etc.
<i>Allamanda cathartica</i>	Yellow allamanda	Apocynaceae	Cuttings / layers	<ul style="list-style-type: none"> • Evergreen shrub or half climber • Bright yellow trumpet shaped flowers • Round the year flowering
<i>Allamanda violaceae</i>	Violet allamanda	Apocynaceae	Cuttings / layers	<ul style="list-style-type: none"> • Evergreen shrub or half climber • Purple flowers
<i>Aphelandra squarrosa</i>	Zebra plant	Acanthaceae	Cuttings	<ul style="list-style-type: none"> • Attractive foliage with coloured midribs and veins • Yellow / reddish pink flowers
<i>Aralia</i> spp. (Syn: <i>Polyscias</i> spp.)	Aralia	Araliaceae	Cuttings / suckers	<ul style="list-style-type: none"> • Hardy plants for outdoors, indoors and pots • Wide variations in leaf shape – rounded, kidney shaped, fern-like leaves, etc. • Fern-like leaves - <i>A. filicifolia</i> • Colouration of leaves - green, brown, etc.
<i>Barleria cristata</i>	Barleria	Acanthaceae	Cuttings / seeds	<ul style="list-style-type: none"> • Purplish blue flowers
<i>Bauhinia tomentosa</i>	Yellow bauhinia	Leguminosae	Seeds	<ul style="list-style-type: none"> • Yellow flowers
<i>Caesalpinia pulcherrima</i>	Pride of Barbados/ peacock flower	Leguminosae	Cuttings / layering	<ul style="list-style-type: none"> • Yellow/ orange scarlet flowers

<i>Calliandra brevipes</i>	Powder puff	Leguminosae	Cuttings	<ul style="list-style-type: none"> • Red, pink powder puff like flowers
<i>Clerodendron inerve</i>	Forest jasmine	Verbenaceae	Cuttings	<ul style="list-style-type: none"> • Evergreen species, suitable for hedging and topiary, white flowers
<i>Crossandra undulataefolia</i>	Crossandra	Acanthaceae	Seeds and cuttings	<ul style="list-style-type: none"> • Orange flowers
<i>Durantha plumeri</i>	Duranta	Verbenaceae	Seeds and cuttings	<ul style="list-style-type: none"> • Suitable for hedging • Attractive foliage, blue flowers and golden yellow berries
<i>Eranthemum bicolour</i>	Eranthemum	Euphorbiaceae	Cuttings	<ul style="list-style-type: none"> • Suitable for hedging • Attractive foliage • Dark red flowers
<i>Galphimia glauca</i>	Galphimia	Malphiagiaceae	Seeds / cuttings	<ul style="list-style-type: none"> • Attractive shrub • Golden yellow flowers in clusters
<i>Hibiscus rosa-sinensis</i>	Hibiscus	Malvaceae	Cuttings	<ul style="list-style-type: none"> • Flower colour - white, yellow, orange, red, pink, etc.
<i>Holmskioldia sanguinea</i>	Chinese hat plant or cup and saucer plant	Verbenaceae	Cuttings / layering	<ul style="list-style-type: none"> • Yellow and red flowers
<i>Ixora coccinea</i>	Ixora	Rubiaceae	Cuttings / layering	<ul style="list-style-type: none"> • Yellow, orange, pink, scarlet, white coloured flowers

<i>Jasminum sambac</i>	Jasmine	Oleaceae	Semi hardwood cuttings	<ul style="list-style-type: none"> • Fragrant white flowers
<i>Jasminum auriculatum</i>	Jasmine	Oleaceae	Semi hard wood cuttings	<ul style="list-style-type: none"> • Fragrant white flowers
<i>Jasminum grandiflorum</i>	Spanish jasmine	Oleaceae	Soft wood cuttings	<ul style="list-style-type: none"> • White with pink tinged flowers, fragrant
<i>Jatropha multifida</i>	Jatropha	Euphorbiaceae	Seeds / cuttings	<ul style="list-style-type: none"> • Red flowers
<i>Lantana camara</i>	Lantana	Verbenaceae	Seed / cuttings	<ul style="list-style-type: none"> • Flower colour - Yellow, white, red, purple, etc • Hardy shrub • Suitable for hedging, rockeries, etc.
<i>Lawsonia inermis</i>	Henna	Lythraceae	Seeds and cuttings	<ul style="list-style-type: none"> • Attractive shrub • Leaves used for colouring palms and nails
<i>Mussaenda erythrophylla</i>	Mussaenda	Rubiaceae	Layering	<ul style="list-style-type: none"> • Scarlet and white flowers
<i>Nerium oleander</i>	Nerium	Apocynaceae	Seeds / grafts / layers	<ul style="list-style-type: none"> • Dark and light pink and white flowers
<i>Nyctanthes arbortristis</i>	Night jasmine / coral jasmine /	Oleaceae	Cuttings	<ul style="list-style-type: none"> • Attractive shrub • White flowers with red pedicels • Highly fragrant flowers

				<ul style="list-style-type: none"> Flowering in winter when jasmine flowers are not available
<i>Pentas lanceolata</i>	Pentas	Rubiaceae	Stem cuttings	<ul style="list-style-type: none"> Red / pink / white / purple flowers
<i>Plumbago auriculata</i>	Blue leadwort / Cape leadwort	Plumbaginaceae	Seeds / cuttings / suckers	<ul style="list-style-type: none"> Blue and white flowers
<i>Rondeletia odorata</i>	Fragrant panama rose	Rubiaceae	Seeds / cuttings	<ul style="list-style-type: none"> Red flowers with yellow centres
<i>Russelia jinceae</i>	Fire cracker plant	Plantaginaceae	Cuttings / division	<ul style="list-style-type: none"> Red, cream flowers Suitable for sunken gardens due to their drooping growth habit
<i>Tabernaemontana coronaria</i>	Crepe jasmine	Apocynaceae	Semi hardwood cuttings	<ul style="list-style-type: none"> Popular and attractive shrub Year round flowering White flowers
<i>Tecoma stans</i>	Yellow bells	Bignoniaceae	Seeds / cuttings	<ul style="list-style-type: none"> Yellow flowers Year round flowering
<i>Thevetia nerifolia</i>	-	Apocynaceae	Seeds / cuttings	<ul style="list-style-type: none"> Yellow flowers

EXERCISE NO. 2

IDENTIFICATION AND DESCRIPTION OF FLOWERING ANNUALS, BULBOUS ORNAMENTALS, CLIMBERS AND CREEPERS

- Annuals are the group of plants which complete their life cycle in one season or one year.
- They are easy-to-grow plants.
- They vary widely in form, habit, colour and size of flowers.
- They beautify the surroundings and exhibit a good show of blooms at low cost and labour.
- They bring a change in the look of the garden with change in the season and keep gardeners busy in raising them throughout the year.

Selected list of annuals

S. No.	Name of plant & family	Height	Colour of flowers	Time of flowering	Method of propagation	Blooming period	Remarks
1.	<i>Ageratum</i> sp. (Floss flower) Compositae	6" – 24"	White, blue	August - September	Seeds	2 ½ - 3 months	Full blooming useful for edging, massing in beds and for mixed borders
2.	<i>Althaea rosea</i> (Hollyhock) Malvaceae	4 – 6 ft.	Various colours	August - September	Seeds	9 months after sowing	Large single or double flowers; useful for screens, borders and for background, suited to hills
3.	<i>Amaranthus</i> sp. Amaranthaceae	2 – 3 ft.	Various colours	August - September	Seeds	1 ½ - 2 months	Foliage or blooms are different coloured Foliage types: <i>A. tricolor</i> , <i>A. salicifolius</i> , <i>A.</i>

							<i>melancholius ruber</i>
4.	<i>Antirrhinum majus</i> Snap-dragon Scrophulariaceae	6" – 18"	Various colours	December - February	Seeds	2 months	For bedding, borders, pots Flower colour - pink, rose, apricot, orange, crimson, white, yellow flowers.
5.	<i>Callistephes chinensis</i> (China aster) Compositae	9" – 36"	Various colours	Aug - Sep. and Jan- Feb.	Seeds	2 months	Suited for borders, can be grown throughout the year .
6.	<i>Coreopsis</i> spp. (Tick seed) Compositae	12" – 18"	Yellow brown or Crimson brown	Aug - Sep Dec - Jan	Seeds	2 months	For borders and flower beds, flowers single or double; yellow, orange and crimson
7.	<i>Celosia</i> spp. Cock's comb	9" – 24"	Fasciated flowers of varying	Throughout the year	Seeds	2 ½ - 4 months	Suited for , flower colour – red, pink, yellow,

	Amaranthaceae		colours				white, etc.
8.	<i>Cosmos bipinnatus</i> Compositae	2" – 5"	White, crimson, rose & purple	Aug - Sep Dec - Feb	Seeds	2 – 2 ½ months	Popular rainy season annual with graceful foliage, can be grown throughout the year.
9.	<i>Dendranthema grandiflora</i> (<i>Chrysanthemum</i>) Compositae	18"	Yellow, white, pink, red, etc.	Sep - Oct	Seeds and suckers	2 ½ - 4 months	Hardy annual or perennial single or double flowers, useful for mixed border, bedding and pot culture.
10.	<i>Dianthus barbatus</i> (Sweet William) Caryophyllaceae	10" – 12"	Various colours	Aug - Sep Dec - Feb	Seeds	2 – 2 ½ months	Popular rainy season annual with graceful foliage, can be grown throughout the year, useful for pots and

							borders
11.	<i>Gaillardia pulchella</i> (Blanket flower) Compositae	1" – 1 ½"	Red yellow	Aug - Sep Dec - Feb	Seeds	2 – 2 ½ months	Suitable for beds, borders and as cut flowers; single or double flowered heads.
12.	<i>Gomphrena globosa</i> (Globe amaranthus or Bachelor's button) Amaranthaceae	4" – 6"	Pink, Purple & Orange	Throughout the year	Seeds	1 month	Suitable for beds, borders and as cut flowers; thrives well in any garden soil.
13.	<i>Gerbera jamesonii</i> (Gerbera) Compositae	6" – 12"	Various colours	Aug - Sep Dec - Feb Apr - May	By divisions or suckers	Throughout the year	Suited for beds and borders, wide range of flower colour.
14.	<i>Helianthus</i> sp. Sunflower	2" – 8"	Yellow with brown (dark) colour	Aug- Sep Dec - Feb	Seeds & Cuttings	2 – 2 ½ months	Staking the plants is essential in the case of tall and unbranched

	Compositae			Apr - May			varieties.
15.	<i>Helichrysum</i> sp. Compositae	10" – 20"	Various colours	Aug - Sep Dec - Feb	Seeds	2 – 3 months	Suited for pots and borders – Everlasting flower.
16.	<i>Impatiens balsamina</i> (Balsam) Balsaminaceae	9" – 12"	Rose like and variegated	Aug - Sep	Seeds	2 months	Suited for borders, can be grown throughout the year
17.	<i>Kochia</i> Chenopodiaceae	12" – 24"	Minute Brownish Pink	Aug - Sep Dec - Feb Apr - May	Seeds	3 months	Suited for pots and as ornamental leaves for flower arrangements. Green in open sunny situations.
18.	<i>Lathyrus odoratus</i> (Sweet pea) Leguminaceae	16" – 18"	Sweet fine colour	Aug - Sep Dec - Feb	Seeds	3 months	Grown in open sunny situations. Suited for hills

				Apr - May			
19.	<i>Petunia</i> sp. Solanaceae	18" – 24"	Various colours	Sep - Oct Dec - Jan	Seeds	3 – 4 months	Suited to flower beds, mixed borders, pot plants, window borders and hanging baskets.
20.	<i>Phlox</i> Polemoniaceae	12"	Various colours	Sep - Oct Dec - Jan	Seeds	1 month	Suited for beds, pots
21.	<i>Pimpinella monoica</i> Lady's Lace	24" – 48"	Small lacy white flowers	Dec – Feb	Seeds	2 months	Coriander like smell of leaves – Small lacy white flowers – Suited for medium high elevations.
22.	<i>Poppy</i> <i>Papaver</i> sp.	24" – 48"	Various colours	Dec - Feb	Seeds	2 months	There are four species useful for cut flowers – Suitable for high

	Papaveraceae						attitudes.
23.	<i>Portulaca grandiflora</i> Portulacaceae	3" – 4"	Various colours	Dec - Feb	Seeds	3 ½ - 4 months	Trailing stem with short thick leaves – Resembles roses – Suited as an edge plant.
24.	<i>Salvia splendens</i> Labiatae	24" – 30"	Scarlet blue Purple pink	Aug-Sep. Dec-Feb.	Seeds	2 ½ months	Can be grown throughout the year – Suited for beds and borders – Pinching back the shoots in early stages builds up better plants
25.	<i>Schizanthus</i> sp. Solanaceae	12" – 18"	Various colours	Aug - Sep Dec - Feb	Seeds	2 ½ months	Cold season annual, pretty foliage of green colour, orchid like flowers of various colours.

26.	<i>Tagetes erecta</i> African marigold Compositae	24" – 36"	Yellow orange variegated	Apr - May Sep - Oct	Seeds	3 months	Tall and erect growing annuals, single or double flowers, effective in beds and mixed borders. Flowers are grown on commercial scale also.
27.	<i>Tagetes patula</i> (Pot marigold Compositae	24" – 36"	Bright yellow, lemon yellow, orange	Aug - Nov	Seeds	2 – 3 months	Suited for beds and borders
28.	<i>Tithonia speciosa</i> (Mexican sunflower) Compositae	48" – 72"	Reddish orange flowers	May - Sep Oct & Dec - Jan	Seeds	3 months	Reddish orange flowers on long stalks, can be grown throughout the year, suitable borders and beds

29.	<i>Verbena hybrida</i> Verbenaceae)	6" – 12"	White, purple and pink	Throughout the year	Suckers, cuttings layers	2 ½ months	Trailing plants, annuals and perennials useful in shrubberies, hanging baskets, rockeries, flower beds and in pot culture.
30.	<i>Vinca rosea</i> (Syn: <i>Catharanthus roseus</i>) (Periwinkle) Apocynaceae	24"	Pure white red	Throughout the year	Suckers, cuttings layers	2 ½ months	Attractive foliage, smooth green leaves, useful for flower beds, plants, borders, rockeries, etc.
31.	<i>Viola tricolor</i> (Pansy) Violaceae	6" – 9"	Violet, blue, yellow, white	Dec - Feb	Seeds	2 – 3 months	Suited for borders and pots – Pretty brilliant coloured flowers.
32.	<i>Zinnia elegans</i>	12" – 30"	Various colours	Dec - Jan Apr - May	Seeds	2 months	Hardy plant, flowers in profusion for a long period, single or double flowers borne on long stalks. Attractive in

							borders and beds.
33.	<i>Zinnia linearis</i>	6" – 9"	Golden orange	Dec - Jan Apr - May	Seeds	1 ½ months	Hardy flowering perennial, linear leaves, beautiful small golden orange flowers, useful for low bed, edging, hanging baskets and rockeries.

BULBOUS ORNAMENTALS

Some popular bulbous plants suitable for landscaping are listed below.

- Amaryllis
- Anemone
- Caladium
- Canna
- Crinum
- Dahlia
- Gladiolus
- Hippeastrum
- Iris lily
- Lilium
- Ornithogalum.
- Oxalis species
- Tiger lily
- Tuberose
- Zephyranthes

CLIMBERS AND CREEPERS

Selected list of ornamental climbers

Botanical name	Common name	Family	Flowering period	Remarks
<i>Adenocalymma allicea</i>	Garlic creeper	<i>Bignoniaceae</i>	Throughout year	<ul style="list-style-type: none">• Evergreen heavy climber• Light mauve flowers
<i>Allamanda cathartica</i>	Yellow Allamanda	<i>Apocynaceae</i>	May-September	<ul style="list-style-type: none">• Quick growing climber with shining foliage and bell shaped Yellow flowers
<i>Allamanda violacaea</i>	Allamanda	<i>Apocynaceae</i>	May-September	<ul style="list-style-type: none">• Quick growing climber with shining foliage and bell shaped Purple flowers

<i>Antigonon leptopus</i>	Coral vine	<i>Polygonaceae</i>	July-October	<ul style="list-style-type: none"> • Deciduous quick growing climber, good for cascading effect • Rose-pink flowers
<i>Bougainvillea</i> species & hybrids	Bougainvillea	<i>Nyctaginaceae</i>	Throughout year	<ul style="list-style-type: none"> • Evergreen climber, valued for bracts and foliage • All colours
<i>Clerodendrum splendens</i>	Clerodendron	<i>Verbenaceae</i>	January-April	<ul style="list-style-type: none"> • Large evergreen climber with coarse textured dark green foliage making contrast with flowers • Red flowers
<i>Clerodendrum inermis</i>	Clerodendron	<i>Verbenaceae</i>	March-September	<ul style="list-style-type: none"> • Dark green foliage, used as hedge. • White flowers
<i>Clitoria ternatea</i>	Mussel shell	<i>Papilionaceae</i> creeper	November-March	<ul style="list-style-type: none"> • Light climber also behaves as annual • Deep blue, white flowers

EXERCISE NO. 3

IDENTIFICATION AND DESCRIPTION OF PALMS, FERNS, CYCADS, ORNAMENTAL GRASSES, CACTI AND SUCCULENTS

PALMS

Commonly grown palms

S. No.	Common Name	Remarks
1.	Royal palm <i>Oreodoxa regia</i>	Large, solitary palm, about 20m tall, with a grey trunk, and graceful, leaves; very good for avenue planting.
2.	Areca palm <i>Areca lutescens</i>	A very attractive clustering palm to about 3 m high, with light green stems, and dark green fronds. It has fragrant, lemon scented, pale yellow flowers, which form into orange fruit about 25 mm (1 inch) long.
3.	Silver date palm <i>Phoenix sylvestris</i>	A very tall, slender palm with recurving, plumose, glaucouse fronds, faster growing. Typically has a swollen base, and retains the leaf bases on the trunk. It is ornamental when young
4.	Miniature date palm <i>Phoenix roebelenii</i>	Quite a popular plant due to its hardiness, attractiveness and small size (good for small areas). Interestingly enough, all the cultivated plants are single trunked, yet in the wild, they are all clumping, and single trunked specimens haven't been found

5.	Fish-tail palm Caryota urens	Popular due to its unique leaf type
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FERNS

Commonly grown ferns

Sl. No.	Common Name	Remarks
1.	Venus hair fern <i>Adiantum capillus</i>	With pale green new growth this fern is excellent for glasshouse or indoor use. It requires humid conditions, and air movement, but will not tolerate hot, dry winds. It grows to about 40 cm
2.	Australian maiden hair A. <i>hispidulum</i>	This hardy fern will grow strongly even if it is neglected. Its young pink or red fronds grow into striking green ones. Grows to about 55 cm. Sub tropical temperatures are best
3.	Bird's nest fern <i>A. nidus</i>	A native of the tropics of the old world, it is a graceful species with long (up to 1 m) undivided fronds, each about 7-20 cm broad. The fronds in a large specimen plant form a cup-like cluster, in the shape of a bird's nest.
4.	Adiantum macrophyllum	This fern is an upright form with bright pink new fronds. This fern is tropical-subtropical. Prefers indirect or filtered light. Suitable for indoors, bush-house or shaded garden position. Grows to 0.6m high x 0.6m wide .12°C to 40°C
5	Tree fern <i>Alsophila crinita</i>	The plants like shade and plenty of moisture. The plants of tree fern groups have a straight, tall stem or trunk similar to that of a palm. The large leaves are borne at the apex of the trunk giving

		the plants a palm-like appearance. The ferns are suitable for cultivation at medium-to-high altitudes. At a lower altitude, one may attempt to grow these plants by providing them with shade and plenty of moisture.
6.	<i>Nephrolepis exaltata</i> (Vernoa Lace)	Small delicate fine lace fronds, with a drooping habit. It is excellent for indoor use, especially in hangers. This fern is not cold hardy

CYCADS

Commonly grown cycads

Sl. No.	Common Name	Remarks
1.	<i>Cycus cercinalis</i> (<i>C. thouarsii</i>)	<ul style="list-style-type: none"> The stem is erect, cylindrical, marked with leaf scars, and usually grows to a height of 4.5 m but may attain a height upto 12m. The stem is usually unbranched. The appearance of the tree is palm-like, with the crown having a graceful rosette of fern-like, stiff, glossy, gracefully curved pinnate leaves, the leaflets being flat on the margins. The young leaves are covered with reddish-brown hair
2.	<i>C. revoluta</i> (Syn. <i>C.inermis</i>)	<ul style="list-style-type: none"> It is commonly called the ‘Sago Plam’ It is about 3 m tall, sometimes branched above. The leaves are 60 cm to 3 m long, recurved, and the leaflets are many, stiff in nature, and rolled downwards.

3.	<i>Dioon edule</i>	<ul style="list-style-type: none"> • An ornamental palm-like foliage plant which is very ornamental and more or less similar in appearance to cycas. • The stem is about 90 cm tall and similar dimension. • The pinnate leaves have spiny tips. The petioles are covered with white wools at young stage. • The cones are 30 cm long.
4.	<i>D. spinulosum</i>	<ul style="list-style-type: none"> • The plants grow up to 15 m and have a slender trunk, crowned by a noble rosette of spreading pinnate leaves up to 1.8 m long. But the margins have 5-8 spines.
5.	<i>Encephalartos caffer</i> (<i>E. caffer</i>)	<ul style="list-style-type: none"> • The plants are handsome, palm-like with a stout stem which may grow up to 5.5 m. A crown may consist of 14 leaves, each about 60 to 120 cm long.
6.	<i>E. hildebrandtii</i>	<ul style="list-style-type: none"> • A beautiful plant growing up to 6m. The leaves are up to 2.7 m long, and the main stalk is woolly when young.
7.	<i>Macrozamia spiralis</i> (Syn. <i>M. tridentate</i>)	<ul style="list-style-type: none"> • The trunk is short and usually underground. The leaves are 80 to 100, up to 1.8 m long, and the flat leaflets are spiny-tipped.
8.	<i>Zamia</i>	<ul style="list-style-type: none"> • This genus differs very little from cycas but the leaves are more leathery and fern-like. • The plants are tropical and subtropical and resemble palms and to some extent ferns.

Ornamental grasses

Some of the commonly grown ornamental grasses are listed below.

Pampas Grass : *Cortaderia selloana*

Deer Grass : *Muhlenbergia rigens*

Wild Blue Rye	:	<i>Leymus condensatus</i>
California Fescue	:	<i>Festuca californica</i>
Red Fountain Grass	:	<i>Pennisetum setaceum</i> var. <i>rubrum</i>
Pampas Grass	:	<i>Cortaderia selloana</i>
Bamboo grass	:	<i>Pohonethram</i> sp.

Cacti and succulents

Some of the common cacti and succulents are described below.

Sl. No.	Common Name	Remarks
1.	<i>Agave</i>	<ul style="list-style-type: none"> Evergreen massive growing plant with short stem and leaves in a close rosette. Leaves are stiff, leathery and fibrous.
2.	<i>Aloe</i>	<ul style="list-style-type: none"> Plants are evergreen with soft, succulent thick leaves, often prickly or spiny resembling the Agaves. Some species have variegated foliage and are suited for pot - culture.
3.	<i>Bryophyllum</i>	<ul style="list-style-type: none"> It is an erect growing succulent herb with thick fleshy simple leaves. It is good pot-plant and could be easily propagated by leaves or leaf cuttings.
4.	<i>Echinocactus</i>	<ul style="list-style-type: none"> Hedge Hog Cactus. Small unbranching. Ovoid or globes succulent, prickly plant. They resemble a ribbed melon of the size of a cricket ball with star-like arrangement of thorns along the ribs. Golden Barrel is another variety with large ribbed green ball armed with straight golden yellow spines.

5.	<i>Furcraea</i>	<ul style="list-style-type: none"> • Ornamental foliage plants resembling agaves the variegated spires are very attractive. • The flower, stem resembles that of Agaves and bears innumerable bulbils from which this species is propagated.
6.	<i>Kalanchoe</i>	<ul style="list-style-type: none"> • Dwarf succulent plant resembling <i>Bryophyllum</i> with thick fleshy leaves from which they are propagated.

EXERCISE NO. 4

IDENTIFICATION AND DESCRIPTION OF INDOOR PLANTS, FOLIAGE PLANTS AND WATER PLANTS

With the growing number of people living in apartments now, the significance of interiorscaping is growing rapidly. Indoor plants are widely used in homes and commercial buildings such as offices, restaurants and shopping malls.

A list of some plants suitable for keeping indoors is given below.

Decorative foliage plants :

- Dieffenbachia
- Aglaonema
- Dracaena
- Maranta
- Ficus varieties
- Palms
- Schefflera
- Brassaia
- Alocassia
- Ferns
- Alpinia
- Oxalis

For hanging baskets :

- Fittonia
- Ferns
- Chlorophytum
- Begonia
- Tradescantia/Rhoeo
- Money plants
- Orchids
- Pilea

- Peperomia

Flowering plants :

- African violets
- Episcia
- Impatiens
- Spathiphyllum
- Orchids
- Flowering begonia
- Calla

Creepers :

- Money plant
- Philodendron
- Syngonium
- Cissus
- Hoya
- *Passiflora tricolour*
- *Piper crocatum*
- Vanilla
- *Hedera helix*

Foliage plants

Foliage plants are those ornamental plants which are grown for their attractive foliage.

Botanical Name	Common Name	Description	Common usage
<i>Aglaonema crispum</i>	Aglaonema or Silver Queen	Green leaves with yellow markings or with light green markings	Houseplant, short leaves cut from parent stem and used as fillers.

<i>Araucaria excels</i> / <i>A. heterophylla</i>	Christmas tree / Araucaria	Tree; pine variety. Enjoys cool climate. Branches green and feathery	Branches used for line or fillers; leaves can be dried.
<i>Areca lutescens</i>	Areca palm	Garden palm. Tall feathery light green fronds.	Houseplant. Clip edges of leaves. Curve into shapes.
<i>Asparagus sprengeri</i> / <i>A. densiflorus</i>	Asparagus	House plant. Fern with many varieties. Feathery or 'furry tail'. Lush green in colour	Dainty as fillers. Useful for breaking two similar lengths of material in an arrangement.
<i>Asplenium</i> sp.	Bird's nest fern	House plant. Long, oval light green smooth and glossy leaves. Fern-like formation.	Use like ferns for fillers and for giving contrasts in textures.
<i>Begonia rex</i>	Begonia	Outdoor potted ornamental plant with pink flowers. Can be kept indoors for short spells. Glossy round leaves tinged pink.	Circular shapes of leave pretty for fillers and for concealing the pinholder/netting.
<i>Bambusa</i> sp.	Bamboo	Outdoor plant. Grows in groves. Tall thick green woody stems with flat, thin pointed leaves.	Remove leaves as they wilt quickly. Stems recommended for Ikebana, geometric or modern designs. Very thick stems can be carved out for making recaptures

			for containers.
<i>Caladium</i> sp.	Caladium	Outdoor plants in gigantic variety. Smaller varieties make ornamental house-plants. Spade shaped leaves, can be variegated with pink strips. Stems fairly long.	Make picturesque additions to flower arrangements. Tall enough to use as lines, or grouped together near focus.
<i>Calathea</i> sp.	Calathea	Hardy and colourful rhizomatous house plant. Leaves are zoned, lined, striped or margined with different shades of colour. Leaves have one basic colour on the upper surface and another beneath.	Widely used for indoor gardening because of the colourful foliage.
<i>Canna indica</i> / <i>C. hybrida</i>	Canna	Garden plant with broad green or purple leaves and bright yellow, red, flecked flowers	Use for large designs, geometric, modern or Ikebana. Trim leaves along edges if necessary.
<i>Casuarina equisetifolia</i>	Casuarina	Outdoor tree. Pine family. Feathery leaves	Use leaves as fillers for all styles
<i>Chlorophytum comosum</i>	Chlorophytum	They produce long, drooping flower stalks ending in a tuft of leaves	Grown for its attractive variegated leaves in rosette in pots, hanging baskets and in ground.

		forming an offset.	They absorb more CO ₂ and release more oxygen. Useful indoor plants.
<i>Cordyline</i> sp.	Cordyline	Houseplant. Thin leaves, sometimes with red edges, growing in clustered heads formation. Dracaena family. Stems throw roots when kept in water over a long period.	Cut stems with the 'head' for completing designs, geometric, modern or Ikebana. Plant is slow growing: individual leaves make good fillers.
<i>Cyperus alternifolius</i> / <i>Schefflera arboricola</i>	Umbrella plant	Outdoor plant or houseplant. Commonly grown beside ponds for decorative value. Tall erect stems with ribbon like leaves in the formation of an umbrella	Clip edges of leaves. Use for creating lines for unusual designs. Use heads as fillers. Stems alone can be used for geometric or modern styles. Dry leaves after use.
<i>Diffenbachia</i> sp.	Diffenbachia	House plant. Broad green leaves with yellow flecks / growing along a thick parent stem.	Used as attractive fillers. Add colour to any design or to an all green arrangement with these leaves.
<i>Dracaena</i> sp.	Dracaena or Song of India	Houseplant, Narrow resilient leaves. Plain green or striped, variegated.	Curve and use for making designs for geometric, modern or Ikebana styles. Use as fillers in focus for

			mass designs
<i>Ferns</i> (individual names vary with each variety)	Ferns	Several varieties. Medium sized fronds growing in shady outdoor conditions. Can be used as houseplants over short spells. Delicate, feathery textures in all varieties	Graceful fillers for all styles. Combine well with delicate flowers. Taller stems can be used for lines
<i>Ficus benjamina</i>		A plant of dense and compact growth with drooping branches. A very attractive plant in pot.	Most of the ficus will tolerate poor conditions where there is little light and perhaps even polluted air.
<i>Ficus elastic</i>	Indian rubber plant	The shoots erect when young. Leaves oblong, glossy green, enclosed in rosy sheath when young.	It is extensively grown as house plant.
<i>Hymenocallis</i> sp.	Spider Lily	Outdoor plant with soft textured long and narrow leaves. White, fragrant variegated varieties	Use leaves to curve into circular shapes for Ikebana geometric or modern designs.
<i>Ipomea tuberosa</i>	Wood rose	Outdoors climber. Cool temperate climates, shiny green leaves.	Seed pods of wood roses make beautiful points in dry arrangement.
<i>Juniperus</i> sp.	Juniper	Coniferous picturesque tree. Commonly trained	Associated with Japanese arrangements. Use

		for bonsai	branches as fillers for mass arrangements
<i>Maranta bicolor</i>	Maranta	Houseplant. Oval green leaves with markings and purple underside	Ornamental as fillers or for creating lines for small arrangements.
<i>Monstera delectiosa</i>	Monstera	Houseplant. Broad green leaves with incisions	Use for fillers or in focus for all styles suitable especially for modern designs. Use leaves selectively, since plant is slow growing.
<i>Philodendron</i> sp.	Philodendron	Outdoor and indoor plant. Climber with arrow shaped leaves. Creeps along tree and can be trained to climb around moss sticks	Cut short stems off parent Use as fillers or group around focus in tall arrangements. Ideal for concealing wire or pin holder.
<i>Scindapsus aureus</i>	Money plant/ Marble Queen/ Pothos	Money plant variety with strongly variegated, leaves with whitish markings, climber	Short stemmed leaves. Used as fillers. Very ornamental as light markings can relieve an arrangement with dark colours or offset dark green foliage.
<i>Syngonium albolineatum</i>	Syngonium/ Arrowhead vine	Houseplant. Arrow-shaped leaves, climbers	Use as fillers or group around focus in tall arrangements.

<i>Thuja occidentalis</i>	Thuja	Outdoor shrub with feathery leaves, associated with Christmas. Evergreen variety. Can be used as an indoor plant.	Use as fillers for western arrangements, also for other styles. Tall stems can be used for lines. Recommended for X'mas arrangements.
<i>Peperomia</i> sp.	Peperomia	There are many variants and the leaves can differ quite a lot. Some species hang down and have fleshy, shiny green leaves and others are variegated with creamy or pink markings or patches.	Plants are showy and easily grown foliage plants.
<i>Pilea cadieri</i>	Gun powder plant / Aluminium plant	Pileas like shade to half-shade	Pileas are great favorites for greenhouses and outdoor rockeries in shades and for hanging baskets indoor.
<i>Rhoeo discolor</i>	Rhoeo	Rhizomatous herbaceous plant. Leaves in rosette, thick and waxy, metallic dark green, glossy purple	Good and hardy foliage plants with attractive colour, grows well in pot and ground in semi-shade with little care.
<i>Sansevieria trifasciata</i>	Snake plant/ Sansevieria	Medium-tall, very hardy plant with thick and	

		fleshy leaves, emerging erect from the ground, sword-shaped with dark green and grey green irregular horizontal bands and yellow margin.	
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Water plants :

Water gardens are becoming one of the most popular landscape projects. They can be designed to fit virtually any existing landscape.

Plants for water gardening

Aquatic plants are basically of four types as detailed below.

1. Deep water plants
2. Bog plants (marginals)
3. Oxygenators
4. Floating plants

Deep water plants:

- Hardy water lilies - *Nymphaea* spp.
- Lotus - *Nelumbo* spp
- Spatterdock - *Nuphar* luteum
- Tropical Water Lilies - *Nymphaea* spp.

Floating plants:

- Azolla - *Azolla* spp.
- Duckweed - *Lemna* spp.
- Water-meal - *Wolffia* spp.
- Water Ferns - *Salvinia minima*

- Water Hyacinth - *Eichhornia crassipes*
- Water Lettuce - *Pistia stratiotes*

Submerged plants or oxygenators

- Anacharis - *Elodea canadensis*
- Cabomba - *Cabomba caroliniana*
- Dwarf sagittaria - *Sagittaria natans*
- Vallisneria - *Vallisneria americana*
- Water milfoil - *Myriophyllum* spp.

EXERCISE NO. 5

VISIT TO ORNAMENTAL PLANT NURSERIES

Details to be collected by students

- Area of the nursery
- List of plants propagated and maintained
- Annual turnover – Number of plants sold, profit gained
- Price details of plants
- Propagation methods adopted
- Nursery techniques adopted
- Marketing strategies adopted

EXERCISE NO. 6

DESCRIPTION AND DESIGNING OF GARDEN STRUCTURES - EDGES AND HEDGES, FLOWER BEDS, FLOWER BORDERS, ARBORETUM, ROSARY, FERNERY, PALMATUM, CARPET GARDEN

Important garden components

Sl.No.	Garden components	Description	Suitable plant species
1.	Edges	<ul style="list-style-type: none">A short border for lawn or ground cover or dividing beds from roads, walks or paths.	<i>Eupatorium</i> <i>Alternanthera</i> <i>Zinnia</i> <i>Gazania</i> <i>Pilea</i> Pot marigold <i>Dianthus deltoids</i> <i>D. squarrosus</i> <i>Phlox subulata</i>
2.	Hedges	<ul style="list-style-type: none">With the help of plants, live hedges can be formed and used as a fence or a green wall.It serves to screen a particular site or building or hiding of unwanted places.They help to partition the garden into several parts.	<i>Acalypha</i> <i>Clerodendron inerme</i> <i>Duranta</i> <i>Lawsonia alba</i> <i>Hamelia patens</i> <i>Jatropha</i> <i>Lantana</i> <i>Plumbago</i> <i>Pomegranate</i>

			<i>Tabernaemontana coronaria</i> <i>Tecoma stans</i>
3.	Flower beds and borders	<ul style="list-style-type: none"> Annuals and herbaceous perennials are grown in flower beds to provide 'mass' effect with different colours. 	Flowering annuals and dwarf perennials - marigold, zinnia, portulaca, verbena, gazania, calendula, etc.
4.	Arboretum	<ul style="list-style-type: none"> Growing of different species of trees in one place is called 'arboretum'. 	Popular ornamental trees are <i>Delonix regia</i> , <i>Peltophorum pterocarpum</i> , <i>Saraca indica</i> , <i>Cassia fistula</i> , <i>Spathodia companulata</i> , etc.
5.	Rosary	<ul style="list-style-type: none"> A rosary is a collection of different types of roses. 	Hybrid teas Polyanthas Floribundas Miniatures Ramblers Climbers
6.	Fernery	<ul style="list-style-type: none"> A fernery is a collection of ferns 	<i>Adiantum capillus</i> (Venus hair fern), <i>Pteris cretica</i> (Table fern), <i>Lycopodium cernuum</i> (Tree fern)
7.	Palmatum	<ul style="list-style-type: none"> A palmatum refers to a collection of different palm types 	<i>Caryota urens</i> (Royal palm), <i>Areca lutescens</i> (Areca palm), <i>Phoenix canariensis</i> (Canary date palm),
8.	<i>Carpet beds</i>	<ul style="list-style-type: none"> The art of growing ground cover plants closely and trimming them to a design or alphabetical letters is called a carpet bed. 	<i>Alternanthera</i> , <i>Echveria</i> , <i>Sempervivum</i> , etc.

EXERCISE NO. 7

DESCRIPTION AND DESIGNING OF GARDEN STRUCTURES - ARCHES, BOWERS, PERGOLAS, ROADS, WALKS, PATHS, BRIDGES, FOUNTAINS AND STATUES

Sl.No.	Garden structures	Remarks
1.	Arches	<ul style="list-style-type: none">• Arches are supports provided for handsome climbers. It should be at least two metre height and one metre wide.
2.	Bower	<ul style="list-style-type: none">• The iron structure which is vertically tall with a short 'L' bend at the top of the structure which partition different components of a garden by remaining as a screen is called a 'Bower'• Climbers or Creepers like Bougainvilla are trailed over the bower so that this gives complete coverage from the other components of the gardens.
3.	Pergola	<ul style="list-style-type: none">• It is just like an enclosed pavement formed by connecting a series of arches together.• Usually flowering creepers are trained over the arches.
4.	Garden paths, roads and walks	<ul style="list-style-type: none">• Roads should be straight in formal gardens and with curvatures in informal gardens.• Width may be 3.3-5 m. Drainage gutters should be provided on both sides.• Foot paths serve better for lead to interior of a garden or a landscape; winding or circular, straight, or spinal or herring-borne designs can be adopted.• Paths in straight lines intersecting each other at right angles are

		<p>suitable for formal gardens.</p> <ul style="list-style-type: none"> • Paths can be laid using bricks, stones, cuddapah stones, mosaic, marble, coal, gravel, concrete, etc. • Sometimes paving with irregularly sized stones create an odd pattern which result in a 'Crazy path'. • The interspaces can be planted with lawn grasses.
5.	Bridges	<ul style="list-style-type: none"> • Bridges are essential constructed feature in a garden to link ponds, to main land cross over streams and in a landscape to bridge the rivers. • The design and colour of bridge should merge with the landscape design; always a rustic design is preferred. They should be structurally sound to with stand the traffic. The culverts along the main road and foot paths also should be rustic. • Bridges made of single or double trees fallen across a stream or a single long stone, arched bamboo bridges will serve better in informal gardens.
6.	Statues	<ul style="list-style-type: none"> • Elegant statues may be provided at different places in a garden. They may be erected over a mound or hillock to provide a natural effect.

EXERCISE NO. 8

PLANNING AND DESIGNING A HOUSE GARDEN

Principal areas in a home garden:

- (1) Public area
- (2) Private area
- (3) Utility area

Important components:

- For aesthetic value - lawn, shrubs, etc.,
- For utility - vegetables, fruits, etc.,
- Other garden features - path, rock, etc.,

Suitable plants:

Trees:

Shade, fruit trees (guava, papaya, etc.)

As focal point in the centre of lawn - *Araucaria*, *Thuja*, *Callistemon*

Shrubs:

- Screening, dividing portions: *Bougainvillea*
- For colour and variety: *Roses*

Other garden features:

- Garden path
- Children play area
- Drying cloths
- Steps
- Compost pit

For round-the-year flowering:

Shrubs:

- *Hibiscus rosasinensis*
- *Nerium oleander*
- *Tecoma stans*
- *Thevetia nerifolia*

Trees:

- *Cordia sebestina*
- *Callistemon lanceolatus*

Making a plan

- Before any actual garden work is undertaken a master plan has to be prepared according to a scale (1: 15 or 1: 20) in which all the features such as house wall, drive-way, paths, flower beds, shrubbery, etc., are plotted.
- A plan prepared on a printed graph paper is of great help.
- If the garden area is sufficiently large, this can be divided into three areas.
 - Approach or Public Area
 - Work or Service Area
- Private Garden Area or Living Area
- Selection of plants is made based on the soil type, space availability, etc.
- The different features are then drawn on the paper with a pencil so that this can be erased if alterations are to be made.
- The first thing is to select the materials for the basic framework such as background, screens, trees needed for shade, the doorway and the corner of the house.
- To this the features needed for effects and beauty as for example plants for foundation planting, flower beds, specimen shrubs or trees are added.
- After everything is finalized on paper these are put into practice on the ground with the help of split-bamboo stakes and rubber hose. The trees are represented by bamboo stakes, while the beds and borders can be plotted by bending a rubber

hose in the desired pattern, Paths, hedge, or screen area can also be marked with stakes.

Exercise: Draw a model home garden plan

EXERCISE NO. 9

PLANNING AND DESIGNING OF ROADSIDE PLANTING

Guidelines in landscaping roads and highways:

- The landscaping of the national and state highways with trees is an important aspect of beautifying our countryside
- Landscaping of a highway also includes all other measures which help enhance the beauty and fits it into the natural landscape of the area.
- Besides its engineering perfection, a highway must look aesthetic, and should not disturb the ecological aspect of the area too much.
- Planting of trees on highways is necessary not only for the purpose of beautification but also for utility and necessity.
- The main purpose of roadside trees is to provide shade during the summer. For this purpose, evergreen trees with spreading crowns should be selected.
- For wider roads, double rows can be planted, with the outer rows having shade trees and the inner rows with flowering trees.
- Neem (*Azadirachta indica* ; Syn. *Melia azadirachta*), Mahua (*Madhuca indica*; Syn. *Bassia latifolia*), *Dalbergis sissoo* (Indian rosewood), and *Shorea robusta* are roadside trees of economic value.
- The trees should be planted 12 m apart in the row and at least 5-6 m away from the edge of the roads, so that they get enough space for spreading and do not interfere with the traffic.
- The selection of trees for a particular locality is done giving due consideration to subsoil water, soil climate including rainfall, locality etc.
- Trees with shallow root system such as *Millingtonia hortensis* and brittle wood as in the case of *Eugenia jambolana*, *Albizia lebbek*, *Cassia siamea*, and *Eucalyptus*

should never be planted on highways, as during storms they get uprooted or branches are broken.

- Neem and tamarind can grow very well in dry localities.
- *Samanea saman* (Syn. *Pithecolobium saman*) and *Dalbergia sissoo* grow better in places having a rainfall of 100 cm or above.

Ornamental shade trees:

- *Polyalthia longifolia*
- *Azadirachta indica*
- *Alstonia scholaris*
- *Averrhoa carambola*
- *Tamarindus indica*
- *Casuarina equisetifolia*

Flowering trees:

- *Bauhinia purpurea*
- *Bauhinia variegata*
- *Cassia fistula*
- *C. javanica* subsp. *Renigera*
- *Jacaranda mimosifolia*
- *Lagerstroemia flos-reginae*
- *Peltophorum ferrugineum*
- *Delonix regia*
- *Saraca indica*
- *Spathodea campanulata*

EXERCISE NO. 10

LAYOUT OF GARDENS IN INDUSTRIAL AREAS

Principles

The following fundamental principles are to be followed for a good industrial landscape.

- i) Simplicity in design should be the key note and undue complexity is to be avoided.
- ii) Variety in a garden gives pleasure. But attempting too much in a small space is not desirable.
- iii) The ground should be so designed that the entire garden is not visible at a glance. It should be full of surprises, with each turn of the path revealing fresh vistas, or disclosing new interests.
- iv) Long and straight garden paths should be avoided.
- v) Judicious employment of more number of plants of different varieties is desirable
- vi) Colour and contrast in the garden are very much desirable which would help in creating a relaxing environment for the tired employees.

Trees suitable for landscaping industrial areas

Trees tolerant to SO₂

- *Casuarina*
- *Albizia*
- *Acacia nilotica*
- *Delonix regia*
- *Moringa oleifera*
- *Eucalyptus*

- *Morus alba*
- *Psidium guajava*
- *Syzygium cumini*

Trees tolerant to Fluoride

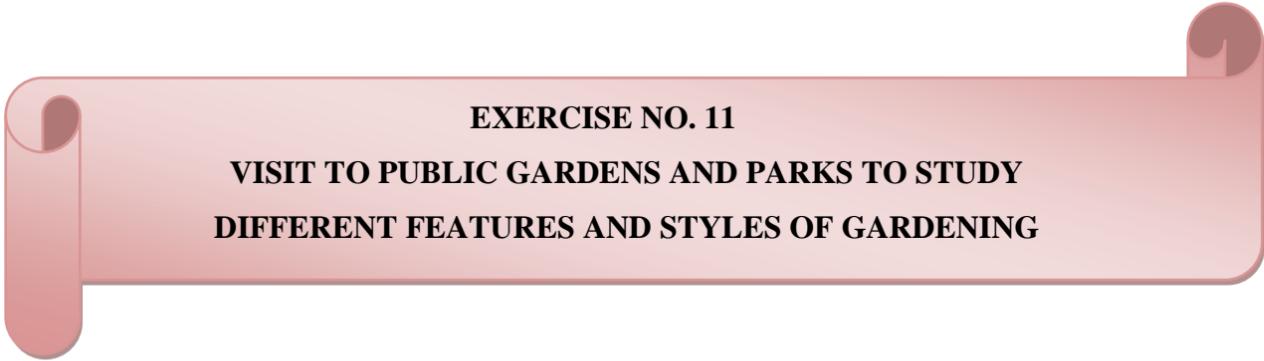
- *Ailanthus excelsa*
- *Cassia fistula*
- *Eucalyptus*
- *Ficus* sp.
- *Thuja compacta*
- *Artocarpus*
- *Pithecelobium dulce*

Trees for thermal power and cement factories

- *Ficus* spp.
- *Azadirachta indica*
- *Tamarindus indica*
- *Butea monosperma*
- *Lagerstroemia indica*
- *Tectona grandis*
- *Grevillea robusta*
- *Holoptelea integrifolia*

Trees to manage smoke and CO₂

- *Ailanthus excelsa*
- *Azadirachta*
- *Bougainvillea spectabilis*
- *Cassia fistula*
- *Delonix regia*
- *Moringa oleifera*

A decorative red scroll banner with rounded ends and a slight 3D effect, containing the exercise title in bold black text.

EXERCISE NO. 11
VISIT TO PUBLIC GARDENS AND PARKS TO STUDY
DIFFERENT FEATURES AND STYLES OF GARDENING

Details to be collected by students

- Overall objective / purpose of the garden
- Area of garden
- Agroclimatic aspects and topography
- Gardening style adopted
- Plant components
- Non-plant components
- Garden principles adopted

EXERCISE NO. 12

LAYOUT OF TERRARIUM / BOTTLE GARDEN, DISH GARDEN

TERRARIUM

Materials required

- **Containers:** Any glass container can serve as a terrarium, provided that it is transparent. A large glass jar, a fish bowl or an old aquarium. Containers made of wood, glass or plastic can also be used.
- **Soil mixes/additives:** Use clean, sterilized peat moss based soilless mix with vermiculite or perlite to enable the soil to hold moisture and oxygen. There should be an initial layer of gravel for drainage (one part gravel to two parts soilless mix). Add charcoal to absorb odour.
- **Terrarium-tools**
 - **Tweezers and long sticks** can be used to dig holes, move items and support plants while they are being planted.
 - **A long, thin spoon** will be helpful in placing soil and drainage material in the container.
 - If a container with a very small opening is used, make a funnel from paper or aluminum foil for placing soil into the container.
 - **Household scissors** are handy for pruning plants before they are planted.
 - **An atomizer** or bulb-type sprayer will be useful for spraying and watering plants in the terrarium.
 - **A stick with a wire loop on the end** is handy for lowering plants into large terrariums with small tops.

Plants suitable for terrarium / bottle / dish gardens

Botanical Name	Common Name
<i><u>Philodendron scandens</u></i>	Heart-leaved philodendron
<i>Selaginella spp.</i>	Irish moss
<i>Asplenium trichomanes</i>	Maidenhead spleenwort
<i>Pilea depressa</i>	Miniature peperomia
<i>Fittonia spp.</i>	Nerve plant
<i><u>Saintpaulia spp.</u></i>	African violet
<i>Pilea cadierii</i>	Aluminum plant
<i>Peperomia caperata, P. sandersii</i>	Peperomia
<i>Begonia rex-cultorum</i>	Miniature Begonia rex
<i>Haworthia spp.</i>	Haworthia
<i>Echeveria spp.</i>	Hen and chicks
<i><u>Crassula argentea</u></i>	Jade plant
<i>Kalanchoe tomentosa</i>	Panda plant
<i><u>Oxalis spp.</u></i>	Oxalis
<i>Asparagus plumosus</i>	Asparagus fern
<i>Dionaea muscipula</i>	Venus fly trap
<i>Iresine herbstii</i>	Bloodleaf iresine

EXERCISE NO.13

LAWN MAKING - PREPARATION OF LAND AND PLANTING

Land preparation

- The soil should retain enough moisture and at the same time the drainage should also be adequate.
- Ideal pH is 5.5 to 6.0. If the pH is very low about half a kilogram of chalk or grounded limestone should be added per square metre area on a sandy soil or a similar quantity of slaked lime should be added to clayey loam soil. In an alkaline soil, gypsum should be added at the same rate.
- A depth of at least of 25-30 cm of good soil is required for obtaining a good lawn.
- In clayey soils, some kind of drainage must be provided. This may be done by drainage pipes or by adding a layer of broken pieces of bricks and gravel
- The soil should be dug deep and turned up subsequently 2-3 times at weekly intervals. Clot of earth and roots of weeds should be removed.
- After the digging is over, the soil is to be manured and graded (levelled).

Commonly used lawn grasses:

Sl. No.	Grass species		Texture of grass	Suitability
	Common Name	Botanical Name		
1.	Korean / Japanese grass	<i>Zoysia japonica</i>	Coarse	Poor sandy soil, open and sunny locations

2.	Mexican grass / Carpet grass	<i>Zoysia tenuifolia</i>	Soft	Open and sunny locations
3.	Bermuda grass / Haryali / Doob grass / Arugu	<i>Cynodon sp.</i>	Fine	Open, sunny locations
4.	Buffalo grass/ St.Augustine grass	<i>Stenotaphrum secundatum</i>	Coarse	Shady locations
5.	Blue grass/ Kentucky grass	<i>Poa pratensis</i>	Medium	Acid soils, higher elevations

Methods of lawn making

1. Seeding

- ✓ The suitable grass for seeding is “Doob” grass (*Cynodon dactylon*),
- ✓ Mix the grass seeds with 5 parts of fine sand for uniform seeding
- ✓ Sow the seeds at a depth of 2 cm uniformly at 2.5 g/m²
- ✓ Seeds take 5 weeks for germination
- ✓ When the grass is about 5 cm in height give a clipping with garden shears.

2. Turfing

- Turf = piece of earth with compact grass on it
- Uniformly cut turfs of 1 sq.ft with a thickness of 2 cm and free from weeds are prepared
- The turf pieces are placed on the prepared ground site and beaten down with turf beater
- Entire turf area should be rolled and watered liberally
- Grass will establish within 10 days

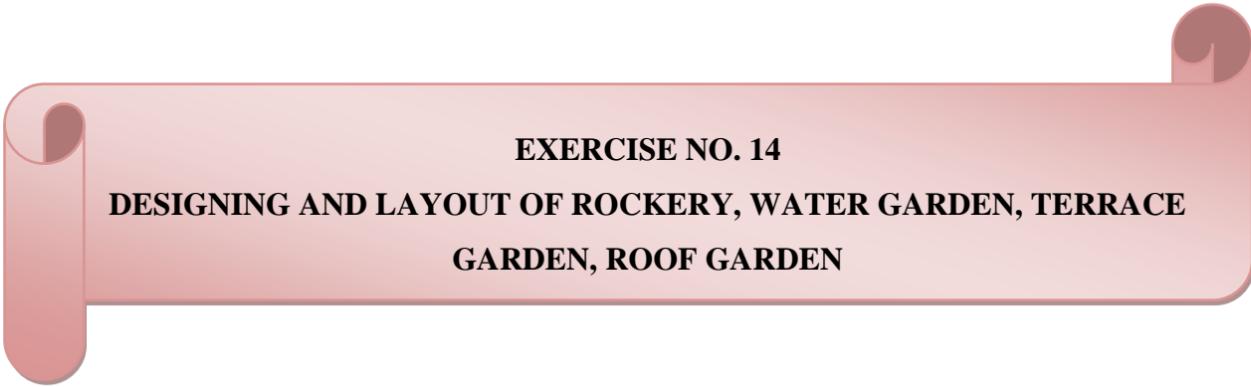
- Turfing is an expensive way of lawn making, but it gives an attractive lawn in a short time

3. Turf plastering

- Grass roots and stolons about 5 cm length are mixed with slurry made up of 1:1 ratio of red earth and cow dung
- It spread uniformly on the surface of a perfectly leveled ground
- Spreading thickness is 2.5 cm
- Watering should be done with a rose can
- The grass will shoot up in 15 days

4. Dibbling

- Cheapest but time consuming method
- Grass slips or grass roots or grass stolons of 5 cm long are dibbled at 5 cm spacing after wetting the prepared ground
- The stolons will establish in 15 days.



EXERCISE NO. 14
DESIGNING AND LAYOUT OF ROCKERY, WATER GARDEN, TERRACE
GARDEN, ROOF GARDEN

ROCK GARDEN

Conditions to be considered:

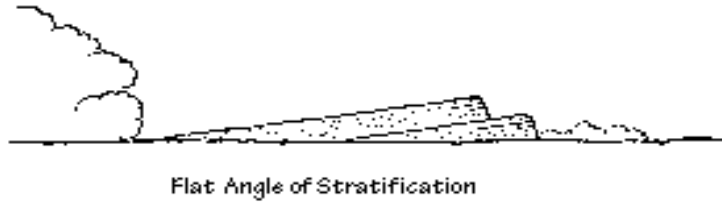
- Lay out must be simple
- Rocks native to the area will look natural
- Large rocks with irregular shapes will help to break monotony
- Limestone performs better than solid rocks
- Limestone usually has depressions in it that can be used for planting mosses and lichens to give a natural look.

Plants:

- Perennials, bulbous plants, cacti and succulents are more suitable
- Plants should tolerate harsh conditions
- Selection according to climate is must

Steps involved:

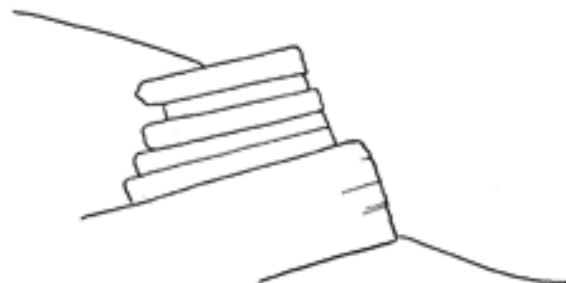
- 1. Site selection**



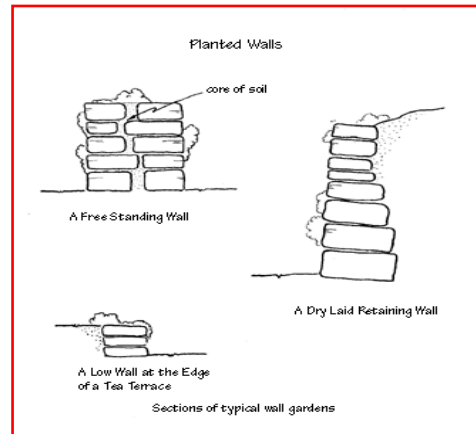
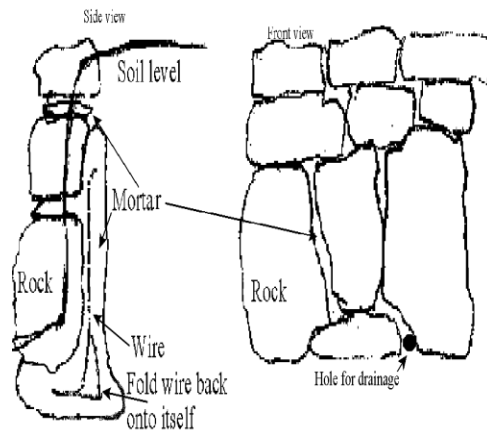
The outcrop built on level ground

2.

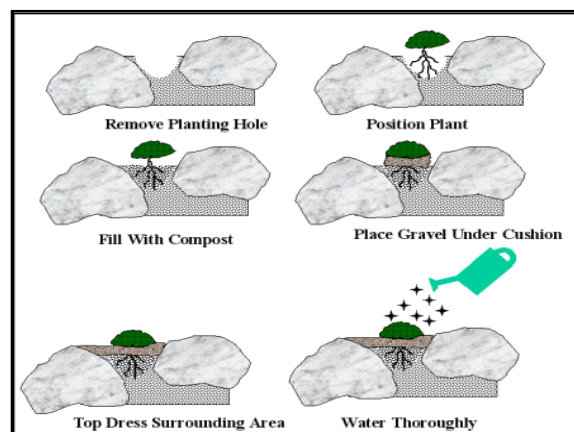
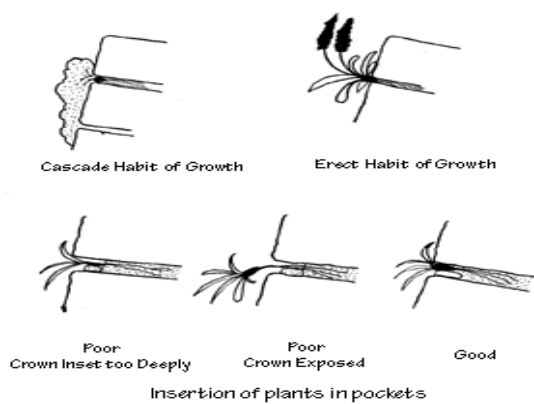
3. Arrangement of rocks



Use of thin pieces to form a stratum



4. Planting



Plants for rock gardens

- *Helichrysum bracteatum* – Strawflower
- *Achillea tomentosa*
- *Anemone blanda*
- *Crocus* spp.
- *Iris* spp.
- *Narcissus* (miniature)
- *Tulipa* spp.
- *Sempervivum*

WATER GARDEN

Aquatic Plants: Basically there are four types of plants

- Deep water plants,
- Bog plants (marginals),
- Oxygenators
- Floating plants

Deep Water Plants:

- Hardy water lilies - *Nymphaea* spp.
- Lotus - *Nelumbo* spp
- Spatterdock - *Nuphar luteum*
- Tropical Water Lilies - *Nymphaea* spp.

Floating plants:

- Azolla - *Azolla* spp.
- Duckweed - *Lemna* spp.
- Water-meal - *Wolffia* spp.
- Water Ferns - *Salvinia minima*
- Water Hyacinth - *Eichhornia crassipes*
- Water Lettuce - *Pistia stratiotes*

Submerged plants or oxygenators

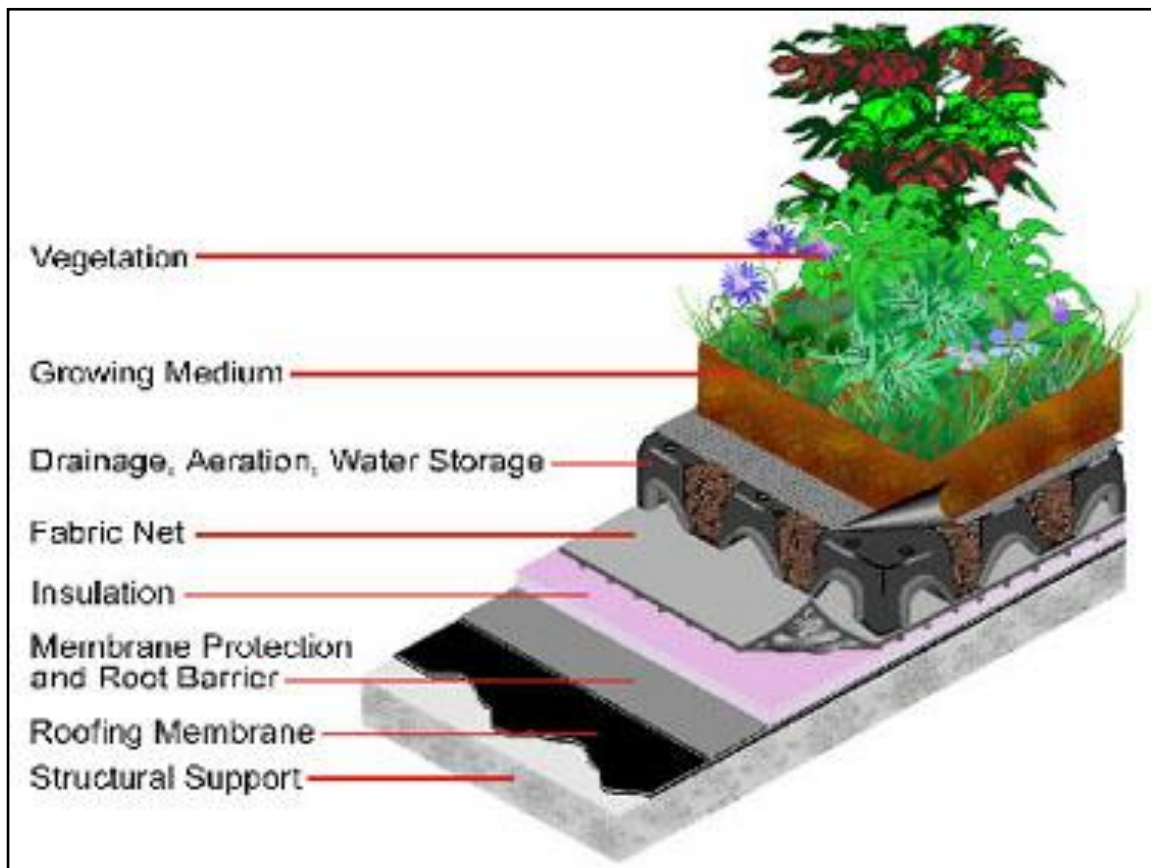
- Anacharis - *Elodea canadensis*
- Cabomba - *Cabomba caroliniana*
- Dwarf Sagittaria - *Sagittaria natans*
- Vallisneria - *Vallisneria americana*

TERRACE GARDEN

- Terrace gardening involves land raising and construction of steps, ramps, walls and paved paths as well as planting of lawn grasses and other plants.
- Since such gardens are mainly for relaxation, they should provide both sunny and shady areas.
- Sheltered, paved terraces invite dining outdoors, lounging, entertaining and children's activities.
- It must offer a fine year-round view of the entire garden.
- Addition of sculptured rocks, a small lily pond with a fountain and water plants will lend visual enrichment.

ROOF GARDEN

Basic layout of a roof garden



To build a garden fit for flowers requires several layers to be constructed:

- **Waterproof layer** - The base layer. Added to the existing surface, this will give greater security and peace of mind even if the roof is already soundly waterproof.
- **Roof membrane** - Waterproofing layers, such as asphalt and bitumen, are very susceptible to damage from plant roots and any root penetration may lead to leaks. A pond liner or butyl lining or 300 micron damp-proof polythene should be laid over the waterproof layer and, wherever possible, in one continuous sheet. Otherwise, the sheets should overlap by at least 20cm.
- **Filter Sheet** - This sheet allows moisture to drain off of the roof whilst ensuring fine materials don't escape.
- **Moisture Blanket** - For extensive living roofs, this blanket will ensure that the growing medium contains enough moisture to support life. Commercial ones can be bought which do not degrade but it is possible to use cardboard or old blankets to achieve the same effect.
- **Drainage layer** - Like the moisture blanket, this helps to retain moisture while allowing excess water to drain away. Commercial systems store water and are made of plastic or geotextile materials. Sedum mat on the roof of an extension.
- **Soils and Substrates** - The top layer. The growing medium should be lightweight and free draining yet of a material that retains moisture. Many people use aggregates mixed with light sub-soils such as crushed porous brick and limestone chippings.
- **Seeds and Plants** - Sow seeds on the substrate, or put in plug plants (small plants in individual cells) and watch them grow.

Suitable plants

- Flowering annuals
- Herbaceous perennials
- Creepers
- Bulbous plants
- Water plants

EXERCISE NO.15
PRACTISING FLOWER ARRANGEMENT, DRY FLOWER MAKING
AND BOUQUET MAKING

(A) FLOWER ARRANGEMENT

Broad approaches in flower arrangement styles:

1. Western style
 - “Mass” effect
 - Arranging flowers in an even symmetry
2. Eastern style / Japanese style / Ikebana
 - Less material
 - Specific rules and angles
3. Modern style
 - Hybrid of above

Rules of construction of Ikebana:

- Its materials are living branches, leaves, grasses, and blossoms, anything can be used and even a small weed can be given an important place in an arrangement.
- Its heart is the beauty resulting from colour combinations, natural shapes, graceful lines, and the meaning latent in the total form of the arrangement.
- The three main components of Ikebana: Heaven, Man and Earth.
- In Ikebana empty space plays an essential part of the arrangement. The elements placed asymmetrically, are given emphasis by the spaces. Thus, the totality of a well-done arrangement brings about a state of serenity and peace to the viewer.

Western flower arrangement:

- Characterized by mass of flowers and foliage

- A balanced formal style which may be for front viewing or to be viewed from all sides.
- The flower arrangement can be a centre-piece on a table, placed on a window-sill, shelf, trolley, bookshelf or cupboard or may be hung on the wall

Types of Western floral arrangements:

1. Circular
2. Triangular
3. Radiating
4. Crescent
5. Horizontal
6. Hogarthian curve

Circular arrangement

- Designed to be viewed from all sides and makes an excellent centre piece for low table.
- It lacks focal point.
- Containers - low round containers or baskets

Triangular arrangement

- Height and width of the arrangement are important criteria.
- Equilateral triangle-shaped arrangement - will be equally as tall as it will be wide.
- The tallest flower is placed exactly in the centre of the container.
- The two 'skeleton' flowers are then placed at each side at equal distance preferably.
- A short-stemmed flower is placed at the front of the arrangement to form the focal point. The triangular arrangement is completed by filling in with the remaining flowers and foliage.
- Asymmetrical triangle - height and width of the arrangement will be altered.

Radiating arrangement

- Has a fan-like outline.
- Line flowers or foliages are used to form the outline - gladiolus, snapdragons, flat fern, and palm fronds are commonly used.
- The height of the arrangement is established first.

- The width of the design is determined by the placement of flowers at each side.
- The fan shape is created by placing flowers or foliages to give the rounded appearance.

Crescent arrangement

- The overall outline is crescent / half-moon shaped.
- The curved foliage is placed to the side (usually left of the centre).
- The focal point is located directly beneath this point at the base of the arrangement.
- The flowers used in this design will be smallest at the points and largest at the center of interest of the arrangement.

Horizontal designs

- The horizontal design makes an excellent centerpiece because it is beautiful when viewed from either the front or the back.
- The height of the arrangement is reduced so that the horizontal length becomes $1\frac{1}{2}$ - 2 times the length of the container
- This gives the arrangement the appearance of being nearly like an inverted crescent design.
- A focal point may then be established on each side to attract attention to the design.
- This style of arrangement may easily be used with candles for an evening dinner party. All foliage and flowers located near the candles should be low enough so they will not be burned as the candle is shortened by the flame.

Hogarthian curve

- The Hogarthian curve is a sophisticated asymmetrical design.
- It has the outline of an 'S'
- Tall stemmed raised containers are used for this design, because a portion of the floral line extends below the rim of the container
- The S shape is separated into two elements, with the upper curve consisting of two-thirds the height of the total design.

- The focal point is often depicted by a cluster of grapes gracefully dangling over the rim of the container.

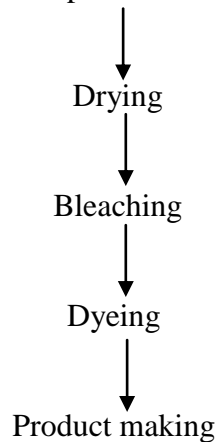
(B) DRY FLOWER MAKING

Tips for collecting plant materials for dry flower making:

- Avoid collecting plants when they are wet or moist from dew.
- Use a sharp knife or pruning shears to cut flowers and plant materials.
- Select plant materials that are without insect or disease problems.
- Place stems in water while harvesting to prevent wilting. Some flowers may hold color better if allowed to stand in water for a few hours. Start the drying process as soon as possible after cutting.
- Collect more plant materials than needed to allow for some loss.
- Be mindful of where you collect plant materials; never remove unlawful or endangered plants.

Processes in dry flower making

Collection of plant materials



(C) BOUQUET MAKING

Materials required

1. Flowers and fillers
2. Bouquet wrapper
3. Ribbon
4. Holder

Flowers for bouquets

Different flowers suit different occasions.

Type of occasion	Suitable flowers for bouquet making
Elegant	Lilium (white)
Informal	Daisy (white petals with yellow centres)
Traditional	<u>Rose</u> (varying colours)
Unique	Sunflower
Simple	Tulip and Gypsophila

Types of bouquets

- Posy
- Crescent bouquet
- Arm bouquet
- Freeform/Contemporary bouquet
- Single stem bouquet
- Pomander
- Cascade bouquet
- Fan
- Hand-tied bouquet
- Oval bouquet
- Heart bouquet
- Mixed flower bouquet
- Fruit bouquet

EXERCISE NO. 16

PRACTICING THE ART OF BONSAI

Selection of plants for bonsai

The suitability of plants to develop a bonsai plant depends on various factors.

1. The plant should be hardy so that it can be grown in a small container for many years with all the manifestations of a living plant.
2. The trunk should develop a natural appearance.
3. The branches should grow in natural but artistic forms.
4. The growth of the plant and appearance should harmonious with the shape of the container.
5. The miniature plant showing seasonal variations in growth and flowering is a very interesting feature of bonsai.
6. Plants of low height and strong trunk, thick at the base are good as bonsai.

Cultural practices in bonsai making

Potting and repotting

- The basic principle in bonsai culture is to restrict and slow down the growth of the plant by selective pruning of roots and branches.
- The method of planting in the pot or container and the training of the plant will depend upon the style of bonsai.

Training

- After planting, the plant is trained according to the style of bonsai.
- The branches or stem can be bent in the desired direction and form with the help of a copper wire which is removed once the required shape is formed.
- Sometimes polythene tape can also be used for the purpose.

Pruning and pinching

- The new growth is pinched once or twice and the branches are pruned sometimes to maintain the shape of the tree.

Planting medium

- The medium for growing bonsai should be porous with a good drainage. Bonemeal or superphosphate in small quantity is added to the planting medium.
- Often the soil in the pot is covered with moss and one or two small stones are placed to give a natural look.

Plant species

- The most commonly used species include Ficus (*F. benghalensis*, *F. religiosa*, *F. benjamina*, *F. microcarpa*), Mulberry (*Morus*), Malpighia coccigera, pomegranate (*Punica granatum*). Pine (*Pinus roxburghii*), Juniper (*Juniperus prostrate*), bottle brush (*Callistemon lanceolatus*), willow (*Salix* sp.), bougainvillea (varieties Sanderiana, Lady Mary Baring, Louise Wathen, Mrs H.C.Buck etc.), Duranta, Bamboo, Chinese orange or Hazara and many other trees and shrubs.
- A few creepers like honeysuckle (*Lonicera japonica*), *Petrea volubilis* and star jasmine (*Trachelospermum jasminoides*) are also suitable for bonsai.

Nutrition

- A mixture of NPK or liquid manure prepared with oilcake (neem or mustard) may be applied once a week after about a month of potting but not during the active growth or dormant stage of the plant.
- The application of bonemeal or superphosphate is useful in flowering while for fruiting add a little potash also to the potting medium.

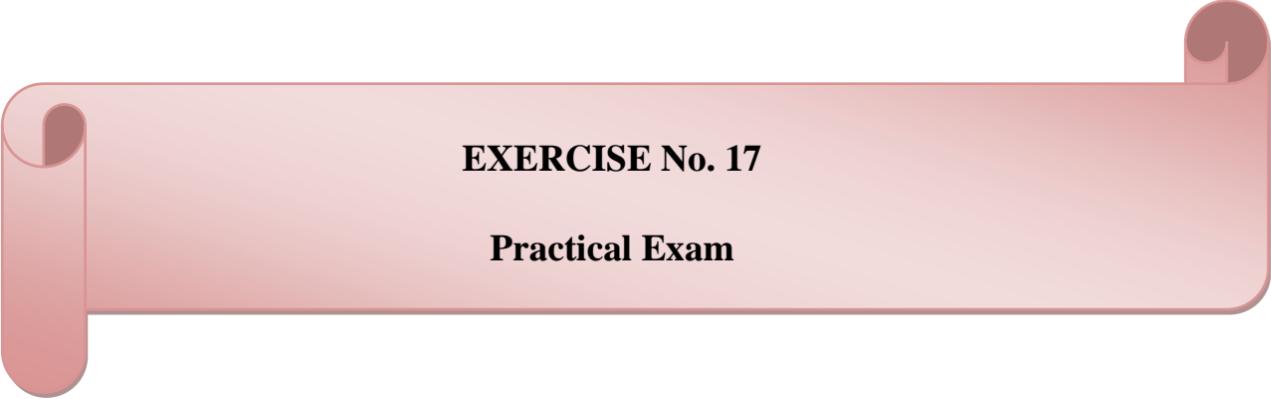
Watering

- Regular and judicious watering is required but overwatering and waterlogging should be avoided.
- Watering is beneficial at the time of flowering but not in bougainvillea as frequent watering results in shedding of flowers.

- Conifers like pine and juniper require less water than other species.

After care

- The soil in the pot should be hoed lightly when it becomes hard.
- Frequent weeding, control of diseases and insect pests by pesticides, pinching and pruning whenever required, regular watering, balanced nutrition and providing adequate sunlight, are the necessary after-care of bonsai.
- Repotting of old bonsai after every 2-3 years is also helpful in proper maintenance of the bonsai.

A horizontal red banner with rounded ends, designed to look like a scroll. It has a darker red border and a lighter red fill. The text is centered on the banner.

EXERCISE No. 17

Practical Exam

