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E – Content

Practical Manual

on

ORNAMENTAL HORTICULTURE

Course Code - HFL 221, Credit Hours - 2(1+1)

(For Undergraduate Agriculture and Horticulture Students)

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E-Manual on
Ornamental Horticulture

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DECLARATION

The course "Ornamental Horticulture" is being offered by **Department of Floriculture & Landscape Architecture** to the undergraduate students of B.Sc. (Hons) Horticulture degree Programme. The E- Practical Manual has been prepared taking into consideration for the students to identify different ornamental trees, shrubs, annuals, climbers and other ornamental plants. In addition, the emerging trends in ornamental horticulture comprising water gardens, rockery, terrace garden, terrariums, bonsai, lawn making have also been discussed to enhance the students' knowledge on the emerging trends of landscaping. This manual is prepared by consulting different text and reference books, training manuals, online sources such as University websites, e-documents, e-books, and other available off-line sources. The authors do not claim for originality of work. This is not meant for the commercial use. The multiplication of this content for commercial activity is prohibited.

AUTHORS

SYLLABUS

Ornamental Horticulture 2(1+1)

Theory

History, definitions, scope of ornamental horticulture, aesthetic values, Floriculture industry, Importance, area and production, industrial importance of ornamental plants and flowers. Importance, classification, design values and general cultivation aspects for ornamental plants viz. annuals, biennials herbaceous perennials, grasses and bulbous ornamentals. shrubs, climbers, trees, indoor plants, palms and cycads, ferns and selaginellas, cacti and succulents, Importance, design and establishment of garden features/components viz. hedge, edge, borders, flower beds, bridges, paths, drives, fences, garden walls, gates, carpet bed, arbour, Patio, decking, retaining walls, shade garden, sunken garden, roof garden, terrace garden, pebble garden, rockery, pools, waterfalls, fountains, bog garden, avenue planting and children garden. Lawn types, establishment and maintenance. Importance of Garden adornments viz. floral clock, bird bath, statutes, sculptures, lanterns, water basins, garden benches etc. Importance of flower arrangement, Ikebana, techniques, types, suitable flowers and cut foliage, uses of vertical garden, bottle garden, terrariums, art of making bonsai, culture of bonsai and maintenance.

Practical

Identification and description of annuals, biennials, herbaceous perennials, climbers, shrubs, trees, indoor plants, ferns and selaginellas, Palms and cycads and Cacti and succulents. Planning and designing and establishment of garden features viz. lawn, hedge and edge, rockery, water garden, carpet bedding, shade garden, roof garden, Study and creation of terrariums, vertical garden, study and practice of different types of flower arrangements, preparation of floral bouquets, preparation of floral rangoli, veni etc., Study of Bonsai techniques, Bonsai practicing and training. Visit to nurseries and floriculture units.

Contents

Exercise No: 1

Identification and description of annuals, biennials and herbaceous perennials

Objective: To know about different types of ornamental annuals used in landscaping based on their growth habits.

Materials required: Pencil and notebook, seeds and plants of annual flower, biennials and herbaceous perennials.

- ✓ **Annuals**

  Annuals are plants that complete their life cycle in one season or one year. They are a group of plants which attain their full growth from seed, flower and die in one year or one season. Mostly they complete their life history in 3 to 6 months. They comprise of several of the most beautiful and easily grown plants widely varying in form, habit of growth and colour. Eg. Balsam, Cosmos, Sweet William etc.

- ✓ **Biennials**

  Biennials are the plants which require two years to complete their life cycle. In the first season, vegetative growth and during the second season's growth, stem elongation, flowering and seed formation takes place followed by the entire plant's death. Eg. Digitalis.

- ✓ **Herbaceous perennials**

  These are non woody plants that produce flowers on maturity within a year before senescence. They remain dormant during winter's and resumes growth during spring. Eg. Chrysanthemum, Catharanthus.

Classification:

A. Based on season

Season	Time (Months)			Examples
	Sowing	Transplanting	Flowering	
Summer annuals	February-March	March - April	May- July	Kochia, Portulaca, Coleus, Zinnia, Gaillardia, Sunflower, Gomphrena etc.
Rainy annuals	Ist week of June	Ist week of July	August - October	Balsam, Cock's comb, Amaranthus, Tithonia, Gaillardia, Zinnia etc.
Winter annuals	Middle of September	October-November	Dec- March	Corn flower, Sweet sultan, Dahlia, larkspur, Poppy, African marigold, Antirrhinum, Helichrysum, Cosmos etc.

B. On the basis of height, annuals are grouped as under:

1) **Tall annuals:** Annual chrysanthemum, Corn flower, Sweet sultan, Dahlia, Larkspur, Poppy, African marigold, Antirrhinum, Helichrysum, Cosmos etc.
2) **Medium annuals:** Acroclinum, Aster, Carnation, Sweet William, Petunia, Clarkis, California Poppy, Nemesia, Gazania, Salvia, Wall flower, Gypsophylla, Lineria, Statice, Candytuft, Calendula, Phlox, Verbena, Dimorphotheca, Nasturtium, etc.
3) **Dwarf annuals:** Ageratum, Anchusa, Brachycome, Daisy, Sweet Alyssum, Mesembryanthemum, Pansy etc.

C. For different purposes:

1) **For Bedding:** Calendula, Phlox, Verbena, Dahlia, Petunia, Nemesia, Sweeet Sultan, Antirrhinum, Acroclinum, Aster, Marigold, Balsam, Zinnia, Sun flower, Gaillardia, Gomphrena etc.
2) **For Pot growing:** Aster, Petunia, Gazania, Cineraria, Salvia, Nemasia, Brachycome, Pansy, Mesembrysanthemum, etc.
3) **For Fragrant flowers:** Sweet William, Sweet Sultan, Sweet Pea, Sweet Alyssum, etc.
4) **For Shady situation:** Salvia and Cineraria
5) **For Screening:** Sweet Pea and Hollyhock
6) **For Rockery:** Mesembryanthemum, Sweet Alyssum, Phlox, Brachycome, Nasturtium, etc.
7) **For Dry decoration:** Nigella, Lady's lace, Bells of Ireland, Statice (Limonium), Helichrysum, Acroclinum, Gomphrena.

Calendula officinallis

Callistephus chinensis

Celosia cristata

Celosia plumose

Chrysanthemum

Cosmos bipinnatus

Dianthus chinensis

Gaillardia pulchella




Gomphrena globose *Helichrysum* *Impatiens balsamina* *Impatiens walleriana*




Limonium sinuatum *Petunia hybrid* *Phlox drummondii* *Pimpinella monoica*

Prepare a list of Summer, Rainy and Winter Season Annuals grown at the campus with their characteristics.

Common name	Botanical name	Family	Time of flowering	Remarks

Assignment:

1. Write down the significance of annuals in landscaping.

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Exercise No: 2

Identification and description of climbers

Objective: To get knowledge about different types of ornamental climbers used in gardens.

Materials required: Pencil and notebook, specimens of different climbers.

Climbers: The plants which have modified organs to climb up on a support due to their weak stem are called climber's e.g. tendrils (*Antigonon leptopus, Pyrostegia venusta*), thorns (Bougainvillea spp, climbing roses) hooks (*Bignonia gracilis*), roots and rootlets (*Campsis grandiflora, Ficus repens*). Climbers are important group of plants used to beautify the pillars, arches, pergolas, building, wall, fence and shrub.

Significance of climbers in landscaping:

1. Climbers are important group of plants used to beautify the pillars, arches, pergolas, building wall, fence, trellis etc.
2. Climbers are also planted to provide screening from the adjacent house for maintaining privacy in city houses.
3. They bear beautiful flowers, produce fragrances and enhance beauty of the surroundings by bringing three dimensional effect in a very small space.

Climbers can be used in different ways in the landscaping of places. Some of the common uses of climbers in landscaping are as follows:

a) **Climbers for growing in pots**: Such climbers can be grown in pots of suitable sizes. Their growth is kept in control by proper training and pruning. e.g. *Bougainvillea species, Clitoria ternatea, Clerodendrum thomsane* etc.

b) **Climbers for making hedge**: Such climbers are suitable for planting as hedge by proper training to create privacy and screening of unwanted sites in the garden. e.g. *Bougainvillea species and Clerodendrum inerme.*

c) **Climber for indoor places:** Such climbers are shade loving and can survive in indoor places. e.g. *Asparagus sp., Hedera sp. Monstera deliciosa, Philodendron sp., Scindapsus sp. Syngonium sp.* etc.

d) **Climber for screening purpose:** Such climbers make a curtain like growth and can be used to create artificial screen to hide some unwanted places in the garden. e.g. *Vernonia elegnaefolia, Pyrostegia venusta*.

e) **Annual climbers:** These climbers are seasonal in nature and can be grown temporarily. e.g. Sweet pea, trailing nasturtium.

f) **Climbers for saline soil conditions**: Such climbers can be grown in saline soil conditions. e.g. *Lathyrus odoratus, Hedera helix* etc.

g) **Climbers for sunny situations**: Such climbers require full sun light for growth and flowering. e.g. *Antigonon leptopus, Bougainvillea species, Campsis grandiflora, Pyrostegia venusta, Quisqualis indica, Wisteria sinensis* etc.

h) **Climbers for partial shade:** Such climbers require partial shade like conditions for growth**.** e.g. *Clerodendrum splendens, Lonicera japonica, Petrea volubilis, Trachelospermum jasminoides* etc.

i) **Climbers having fragrant flowers**: Such climbers bear scented flowers and spread their fragrance in surrounding area. e.g. *Hiptage benghalensis, Jasminum grandiflorum, J. Officinale, Clematis paniculata, Trachaelospermum jasminoides* etc.

Garlic vine

Golden trumpet

Purple allamanda

Amphilophium paniculatum

Coral creeper

Glow vine

Bougainvillea sp.

Clematis gouriana

Bleeding heart vine

Clerodendron splendens

Clitoria ternatea

Cryptostegia grandiflora

Morning glory

Helicopter flower

Wax plant

Jasminum spp.

Pandorea jasminoides

Passiflora racemose

Petrea volubilis

Porana paniculata

Pyrostegia venusta

Vallaris solanacea

Thunbergia mysorensis

Thunbergia grandiflora

Prepare a list of important climbers with following details:

Common name	Botanical name	Family	Time of flowering	Remarks

Assignment:

i. Write down the significance of Climbers in landscaping. Write different climbers uses for screening, arches, pergolas etc.

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Exercise No. 3

Identification and description of shrubs

Objective: To get knowledge about different types of shrubs.

Material required: Pencil and notebook and specimens of shrubs.

Shrubs are defined as woody or semi woody perennial bushy plants with solitary or branched stem. Shrubs help to maintain the natural balance in the ecosystem and provide suitable habitat for wild life and help in soil and water conservation.

Landscaping use of shrubs:

- ✓ A stretch of shrubs is 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.

1. Prepare a list of important shrubs with following details:

Common name	Botanical name	Family	Time of flowering	Remarks

✓ **Assignment:**

1. Write down the significance of shrubs in landscaping.

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Exercise No.4

Identification and description of trees

Objective: To get knowledge about different types of trees.

Material required: Pencil and notebook and specimens of different flowering trees and shrubs.

Trees are referred as woody perennial with single trunk up to 1.5 m of height having well defined canopy and root system. They bring changes in skyline and break monotony due to their varied height, shape, foliage texture and flower colour etc.

Classification of trees in landscaping based on utility

1) **For flowers:** In general, there are several trees which are grown for their attractive flowers enhanced beauty of garden and surrounding by producing profuse and elegant flowers. These are *Amherstia nobilis*, *Barringtonia racemosa*, *Bauhinia purpurea*, *Butea monosperma*, *Callistemon lanceolatus*, *Cassia marginata*, *Cassia nodosa*, *Erythrina blackeii*, *Erythrina indica*, *Lagerstroemia speciosa*, *Michelia champaca*, etc.
2) **For foliage:** Trees that are planted for their show ornamental foliage comes under it. Such trees bear ornamental flowers which in general do not produce flowers or bear inconspicuous flowers. These are *Adansonia digitata*, *Alstonia scholaris*, *Araucaria cookie*, *Casuarina equisetifolia*, *Cedrus deodara*, *Cupressus funebris*, *Grevillea robusta*, *Pinus longifolia*, *Podocarpus macrophylla*, *Salix babylonica*, etc.
3) **For variegated foliage:** These are trees having beautiful variegated foliage. Tricolour Beech (*Fagus sylvatica*), *Roseo marginata*, *Cercis Canadensis*, *Ficus benjamina*, *Ficus elastica*, *Ficus religiosa* (variegated), Ornamental orange (variegated), etc.
4) **For fruits:** These trees are basically planted for fruits. These include *Mangifera indica*, *Averrhoa carambola*, *Emblica officinalis*, *Tamarindus indica*, etc.
5) **For fragrance:** There are several trees that are planted for beautiful fragrant flowers. Some of them are *Magnolia grandiflora*, *Michelia alba*, *Michelia champaca*, *Nyctanthes arbor-tristis*, *Mesua ferrea*, *Plumeria alba*, *Plumeria rubra*, etc.

Jacaranda mimosifolia

Kigelia pinnata

Plumeria acutifolia

Cassia spectabilis

Delonix regia

Azadirachta indica

Callistemon lanceolatus

Ficus benghalensis

Michelia champaca

Tabebuia argentea

Peltophorum inerme

Melia azedarach

Araucaria cookii

Ficus religiosa

Bombax ceiba

Solanum macranthum

Butea monosperma

Acacia auriculiformis

Cassia javanica

Cochlospermum gossypium

Spathodea campanulata

Lagerstroemia speciosa

Millingtonia hortensis

Polyalthia longifolia

Prepare a list of important trees with following details:

Common name	Botanical name	Family	Time of flowering	Remarks

✓ **Assignment:**

1. Write down the significance of trees in landscaping.

Exercise No.5

Identification and description of indoor plants

Objective: To get the knowledge about indoor plants.

Material required: Pencil and notebook, specimens of plants.

Indoor Plants: Indoor plants also known as house plants are those plants that are grown indoors. The art of growing and arranging plants indoors at suitable places in the house for beautification is called indoor gardening. It may be planted inside the house or any area receiving partial or semi shade. Indoor plants are chosen for their ability to adapt to indoor conditions, which typically include lower light levels, controlled temperatures, and less humidity than outdoor environments.

Some popular types of indoor plants include:

- Flowering plants (e.g., African Violets, Begonias)
- Foliage plants (e.g., Spider Plants, Snake Plants)
- Succulents (e.g., Aloe Vera)
- Ferns (e.g., Boston Ferns, Maidenhair Ferns)
- Peace Lilies
- Dracaena
- Philodendrons
- Bamboo Palm

Many indoor plants originate from tropical or semi-tropical regions, as these plants are often adapted to lower light and warmer temperatures.

Benefits of indoor plants

- Improved Air Quality
- Stress Reduction
- Improved Humidity Levels
- Noise Reduction
- Improved Mental Health
- Aesthetic and Decorative Value
- Environmental Benefits
- Connection to Nature

Prepare a list of important Indoor plants with following details:

Botanical name	Common name	Family	Time of flowering	Remarks

✓ **Assignment:**

1. Write down the significance of indoor plants in landscaping.

Exercise No.6

Identification and description of ornamental palms, cycads, ferns and selaginella

Objective: To get the knowledge of ornamental palms, cycads, ferns and selaginella.

Material required: Pencil and Notebook, specimens of plants.

Palms, Cycads, Ferns and Selaginella

- ✓ **Palms:** An unbranched evergreen tree of tropical and warm regions with a crown of very long feathered or fan shade leaves.
- ✓ **Ferns:** Ferns are flowerless plant that has feathery or leafy fronds and are produced by spores released from the undersides of the fronds.
- ✓ **Cycads:** Cycads are fascinating, ancient plants that belong to a group called gymnosperms, which also includes conifers and ginkgoes. Cycads are primitive palm like plants that inhabit tropical and subtropical regions and have appeared over 300 million years ago, making them some of the oldest seed-producing plants on Earth.
- ✓ **Selaginella:** Selaginella is a pteridophyte. It is also called spike moss or club moss. Selaginella species are typically found in moist, shaded environments and are notable for their distinctive, often intricately branched, and scale-like leaves. It is the largest and the only living genus of the family Selaginellaceae and are considered living fossils, as they have existed since the Devonian period. It contains more than 800 species distributed all around the world with the highest diversity found in the tropical regions.

Prepare a list of important Palm, Cycads and Fern with following details:

Common name	Botanical name	Family	Propagation	Remarks
Palm				

Cycads				
Fern				
Selaginella				

✓ **Assignment:**

1. Write down the significance of Palm, Cycads and Fern

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Exercise No.7

Identification and description of Cacti and Succulents

Objective: To get the knowledge of cacti and succulents.

Material required: Pencil and notebook, specimens of plants of Cacti and Succulents.

Cacti and Succulents:

- ✓ C**acti:** Cacti are a group of succulents belonging to the family **Cactaceae.** They have evolved unique adaptations to survive in harsh, dry environments such as deserts. They are most commonly associated with deserts, but some species also grow in tropical and subtropical regions.
- ✓ **Succulents:** The term "succulent" refers to the plant's water-storing capability rather than a specific botanical family, so succulents come from various plant families. They are a diverse group of plants that are known for their ability to store water in their fleshy, thick, and often swollen tissues. These structures are specially adapted to retain water, allowing succulents to survive in dry or arid environments with limited rainfall.

Prepare a list cacti and succulents giving their English names and Botanical names.

S. No	Scientific Name	Common name
Cacti		
1.		
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3.		
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6.		
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8.		
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Succulents		
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✓ **Assignment:**

1. Write down the significance of Cacti and Succulents in landscaping.

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Exercise No.8

Planning, designing and establishment of garden features – Lawn

Objective: To get the knowledge about planning, designing and establishment of lawn**.**

Materials: Spade, khurpi, rope, measuring tape, well rotten F.Y.M. or compost, fungicides, straight edge, pegs, grass or seeds of grass, roller or flat iron plate, lawn mower.

Lawn - A lawn can be defined as a green carpet or landscape. It is a basic feature for home garden and an essential feature for any other type of garden. In home garden, a lawn improves the appearance of the house, enhances its beauty, increases conveniences and usefulness thus adding economic value to the real estate.

Methods: For making a lawn following steps should be taken -

A) Selection and Land preparation

A site for lawn should receive full sunshine as under shade, grass plants do not grow. The best situation will be the southern side and the next best is the south- east and south- west of the building. Most grasses do not grow well under the drip of large trees. Therefore, it is desirable that the land piece selected for a lawn should not be closer to big trees. Fertile loamy soil having enough humus is desirable for the growth of the lawn grasses. The soil should retain enough moisture and at the same time it should have adequate drainage. The preparation of the ground bed and drainage are essential for a lawn. A slight shape is desirable in small size plots to ensure natural drainage during rainy season. Rough surface levelling by eye estimation should be done prior to digging. After rough levelling is completed, the digging work should be done. Through preparation of the ground is most essential for the success of the lawn, digging operation should be done by the trenching. At each stage of digging care should be taken that earth clods are broken and soil is pulverized thoroughly if clods are left, the ground will take a long time to settle. During process of digging all inert material like stone, old masonry and grass roots etc should be removed. Special care should be taken to remove the roots of nut grass (*Cyprus rotundus*).

In most parts of India digging is done during the during summer month (April and May). After the trenching is completed, the soil is left to dry in the scorching sun for amonth. 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 are removed. After proper digging, the soil is to be manured and

levelled. In fertile soils, organic manures are not added but poor soils are dressed with organic manures. Any freshly dug up soil takes a long time to settle. In heavy rainfall areas, the work is done by the pouring rains. In other areas, the prepared soil is watered heavily after making the bunds all along the periphery. The accumulation of water will show the area of depression which should be smoothened by shifting the soil from other places. The flooding should be repeated 2-3 times and between each watering, the sprouted weeds should be removed. The final levelling is done with the help of pegs, straight edge and spirit level.

B) Planting of lawn:

For an excellent lawn, the grass should be of fine quality with its narrow evergreen and fast growing foliage. The most suitable grass for the most parts of India is Doob grass (*Cynodon dactylon*). The grass thrives well under hot and sunny weather but under shade its growth is suppressed. The other finer varieties are *Agrostis tennis, A. caina, Festuca ovina, F. rubra*, while the cheaper mixtures consist of perennial rye grass *(Lolium perenne)* and crested dogs tail (*Cynosurus cristatus*). The wood meadow grass *(Poa nemoralis*) grows well under shades of trees. If irrigation facilities exist, a lawn can be laid out any time during the year. Under India condition, it is better to sow the grass seeds after one or two monsoon showers while the grass roots are planted at beginning of the monsoon. The following different methods of planting are used.

a) **Seed sowing**:

For seedlings, it is important to procure a good quality seeds free from weeds seeds. Doob grass seed is very light and fine. Therefore, proper care should be taken during sowing. Prior to sowing, the surface is scratched to a depth of 2.5 cm with the help of a garden rake. The total area should be divided into equal plots if 200 to 300 square meters to ensure even sowing of seeds. The sowing should be preferably undertaken on a windless day. The seeds is divided at the rate of 500 g per 200 square meters and mixed with double of the quantity of finely sifted soil and broadcasted by hand. After sowing is completed, the rake is drawn lightly twice in opposite directions to mixed up the seed. It will be advisable to cover the seeds with a thin layer of finely sifted soil. The plot should be lightly irrigated at regular interval.

b) **Dibbling**:

A well matured unrooted or rooted Doob grass cuttings are obtained from close cut lawn on nursery or from a lawn scrapping. The roots or grass, thus obtained are dibbled (planted) in

ground at 7-10 cm apart when it is slightly moist. The soil is kept moist by frequent watering till the grass sprouts. Roots of Doob grass sprout easily and cuttings or off shoots roots readily under moist condition and within 7 weeks the grass will be ready for first cutting.

c) **Turfing**:

The quickest method of developing a lawn is by turfing. Turf is piece of earth of about 5 cm thickness wit grass thickly grown over it. The pieces may be of small squares or in rolls of small width (30 cm). The turfs must be free from weeds and consists of the required lawn grass. These should be laid closely to each other in a bounded alternate pattern like brick 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 material. 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 using these methods, 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 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 but spreading 2 cm of dry soil and watered at regular interval. This method is not very suitable especially in a dry and variable climate.

1. **Write the common and botanical names of various lawn grasses suitable for different condition of India.**

S.No	Grass name	Botanical name	Texture of grass	Suitability
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✓ **Assignments:**

1. Select and prepare the land for planting of lawn.
2. Practice various methods of planting lawn.
3. Maintenance of Lawn.
4. If the lawn is not properly maintained, it will become useless within no time. The following operation should be followed. Write in brief about each.
   a) Weeding:

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   b) Liming:

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   c) Rolling, moving and sweeping:

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   d) Irrigation **:**

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e) Scraping and Raking:

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Exercise No. 09

Planning, designing of and establishment of garden features - Edges and Hedges.

Objective: To get the knowledge about planning, designing and establishment of edges and hedges.

Material required: Pencil and notebook, khurpi, spade, rope liner, specimens of plants of Edges and Hedges.

Hedge: Hedges are structures or plants used to create a boundary or enclosure, often found in gardens and landscapes. It is a line of closely planted shrubs and trees that are trained and pruned to form a screen of dense foliage. They can be made from various types of shrubs, trees, or other vegetation, and are commonly used for privacy, wind protection, and aesthetic appeal. The spacing of plants in a hedge depends upon the nature of growth and their canopy coverage. Generally, trees are planted 10-12 ft spacing and shrubs at 0.5-4 ft. spacing.

Plants suitable as a hedge: *Inga dulcis, Casuarina equsetifolia, Clerodendrum inermi, Lantana spp., Bougainvillea spp, Nerium indicum etc.*

Edge: Edges refers to the boundary or border that defines the perimeter of a garden bed, pathway, or landscaping feature. It can be both functional and aesthetic, serving to organize space and enhance the overall design. An edge represents a line of closely planted low height plants (generally less than 1 ft) around the border of flower beds, paths, lawn (as informal edging) or lining with small bricks, concrete blocks (formal edging) in order to demarcate or outline the boundary and not to screen the view.

Plants suitable as an edge: *Pilea muscosa, Iresine herbstii, Cuphea, Duranta, Alternanthera, Zephyranthus* etc. Annuals such as Sweet alyssum, Portulaca, Ice plant, perennial verbena and Brachycome etc. can also be used as an edge plants.

✓ **Assignment**

Write the important feature of hedges and edges in a garden.

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- ✓ **Exercise:**

Make a hedge and edge of 10 m length area. Write the method and procedure of making hedges and edges.

Exercise No. 10

Planning, designing of and establishment of garden features – Rockery

Objective: To get the knowledge about planning, designing and establishment of Rockery.

Material required: Pencil and notebook, khurpi, spade, rocks, stones, specimens of plants suitable for rockery.

Rockery - A **rockery** is a garden feature that consists of an arrangement of rocks and plants, designed to imitate a natural landscape. It typically involves the use of various sizes and types of stones, often arranged in a way that creates elevation and visual interest. Rockeries are often planted with alpine plants, succulents, and other species that thrive in rocky, well-drained conditions.

1. Planning

- **Location**: Choose a spot with good drainage and plenty of sunlight. Consider the natural slope of your garden for a more natural look.
- **Design**: Sketch a layout considering the arrangement of rocks, plants, and pathways. Think about height variation and visual balance.

2. Materials

- **Rocks**: Select a variety of sizes and types. Use larger stones as focal points and smaller ones for filling gaps.
- **Soil**: Use well-draining soil, ideally a mix of topsoil, sand, and gravel.

3. Preparation

- **Site Clearing**: Remove grass, weeds, and debris from the area.
- **Ground Leveling**: If necessary, level the ground or create tiers for visual interest.

4. **Building the Rockery**

- **Foundation**: Lay down larger rocks first, ensuring they are stable and partly buried for a natural appearance.
- **Layering**: Add smaller rocks around the larger ones to fill gaps and create texture.
- **Soil Placement**: Fill in soil around the rocks, leaving space for planting.

5. Planting

- Choose drought-tolerant and rock-loving plants like alpine species, cacti and succulents, bulbous and ground covers.

- Plant taller species at the back or center (if viewed from all sides) and shorter ones in front. Group plants in odd numbers for a natural look.
- Water the plants well after planting.

6. Maintenance

- **Weeding**: Regularly remove weeds to prevent competition for resources.
- **Watering**: Adjust watering based on the needs of your plants, especially during dry spells. Watering should be done at least once in three days. Drip system of irrigation may also be adopted.
- **Pruning**: Trim back overgrown plants as necessary to maintain the shape and health of your rockery.
- **Replacement of soil:** Rockery plants need replacing of soil at least every 2-3 years as the soil become sour and infertile.
- **Manuring:** Plants may be top dressed every year with compost consisting of a good garden soil, sand and fine leaf mould in equal proportion to the top few centimeters of soil is scraped out and in its place new compost is filled in along with a little quantity (125g) bone meal depending upon the plants. Periodically rock plants should be fed with liquid manure also.

Suitable plants

1. **Annuals:** All annuals may be accommodated in the rockery depending on their height in between shrubs and other perennial plants. Asclepias, Calliandra, Clerodendrum, Crossandra, Cuphea, Euphorbia, Zinnia, Phlox, Verbena.
2. **Shrubs*:*** *Duranta, Juniperus, Lantana sellowiana, Russelia juntia, Thuja orientalis* etc.
3. **Cacti and Succulents:** Adiantum, Opuntia, Agave, Kalanchoe, Sansiveria, Haworthia, Furcarea etc.
4. **Ferns:** Nephrolepsis, Polypodium and Adiantum etc.
5. **Shade plants:** *Impatiens sultaniana, Pedilanthus tithymaloides, Pilea muscosa, Portulaca spp,* minature roses**,** *Zebrina pendula, Tradescantia albifolia, Vincea rosea* etc.
6. In addition to above plants, with careful selection of large group of annuals, bulbous plants, other shrubs and other ornamental plants can be selected and grown in the rockery depending upon the necessity and environmental condition.

✓ **Assignment:**

Write the important feature of Rockery in a garden.

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✓ **Exercise:**

Make a small rockery in your department. Write the method and procedure adopted for making rockery.

Exercise No. 11

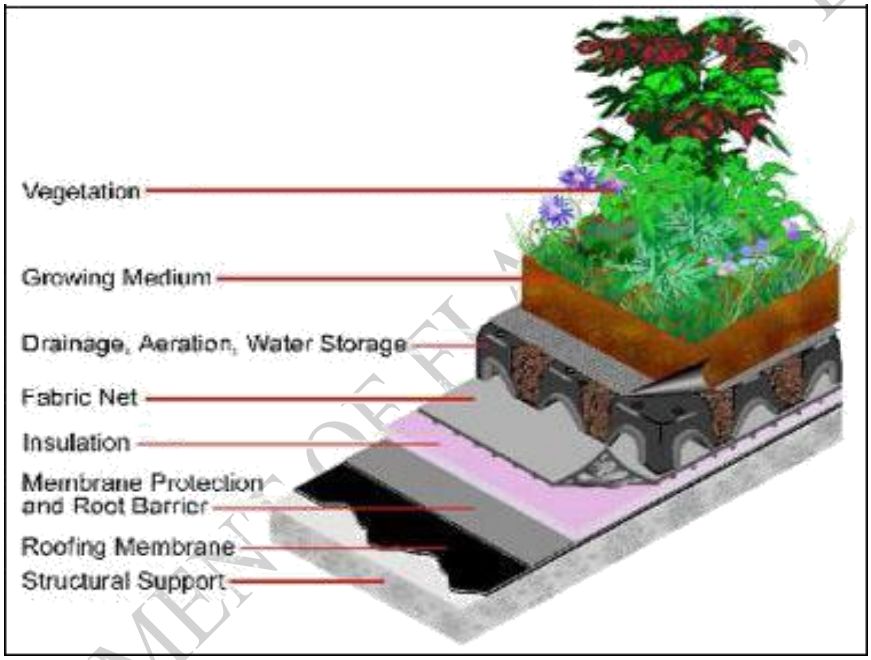
Planning, designing of and establishment of garden features – Roof garden, Water Garden, Carpet bedding, Shade garden

Objective: To get the knowledge about planning, designing and establishment of Roof garden, Water Garden, Carpet bedding, Shade garden**.**

Material required: Pencil and notebook, khurpi, spade, specimens of plants suitable for various gardens

A. 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 light weight 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

B. WATER GARDEN

A water garden is a landscape feature that incorporates water, often in the form of a pond, along with aquatic plants and sometimes fish and other wildlife. It serves both aesthetic and ecological purposes, creating a tranquil space for relaxation while also supporting biodiversity.

Deep Water Plants			
•	Hardy water lilies	-	*Nymphaea spp.*
•	Lotus	-	*Nelumbo spp*
•	Spadderdock	-	*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*
Submerged plants or oxygenators			
•	Anacharis	-	*Elodea Canadensis*
•	Cabomba	-	*Cabomba caroliniana*
•	Dwarf Sagittaria	-	*Sagittaria natans*
•	Vallisneria	-	*Vallisneria americana*

C. CARPET BEDDING

Carpet bedding is a unique landscaping technique that involves creating colorful and textured patterns using low-growing plants, often annuals or perennials. This technique is used to transform a garden into a vibrant, colourful, living tapestry.

Types of Carpet Bedding Plants:

1. Succulents (e.g., sedum, echeveria)
2. Groundcovers (e.g., creeping thyme, vinca minor)
3. Annuals (e.g., petunias, marigolds)
4. Perennials (e.g., hostas, daylilies)
5. Grasses (e.g., mondo grass, blue oat grass)

D. SHADE GARDEN

Shade gardens are landscaped areas specifically designed for plants that thrive in low-light conditions. These gardens can be both beautiful and functional, making the most of areas that receive little direct sunlight.

Shade gardens are outdoor spaces designed to thrive in areas that receive partial or full shade, often created under trees, on the north side of buildings, or in areas with dense

foliage. These gardens require careful plant selection and design to compensate for the lack of direct sunlight.

✓ **Assignment**

- Write the important features of water garden in landscaping.

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- Write the important features of Roof garden in landscaping.

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- Write the important features of Carpet Bedding

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- Write the important features of shade garden in landscaping

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Exercise No.12

Study and creation of Terrariums

Objective: To get the knowledge about creation of Terrariums.

Materials required: Containers, soil mixes, additives, a long thin spoon, scissors, stick with a wire loop, bulb-type sprayer.

Terrariums: A terrarium is a small garden in an enclosed environment or in a miniature ecosystem within a transparent container, typically made of glass. The plants inside a terrarium are usually tropical or small species that thrive in humid environments.

Indoor gardening with terrariums is entertaining and one of the attractive ways to integrates plants into any home furnishings.

With proper care ensuring adequate bright light, a terrarium will create a humid atmosphere that will enable growth of certain plants which normally do not survive under low humidity. Terrariums are placed as a specimen feature for indoor decorations.

Plants suitable for terrarium / bottle / dish gardens

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

✓ **Assignments:**

1. Prepare a Terrarium.
2. Write common name and botanical name of different plants suitable for terrarium / bottle / dish gardens.

S .No	Common name	Botanical name
A.		
B.		
C.		
D.		
E.		
F.		
G.		
H.		
I.		
J.		
K.		
L.		

Exercise No. 13

Study and creation of Vertical garden

Objective: To get the knowledge about creation of Vertical garden.

Material required: Pencil and notebook, khurpi, specimens of plants suitable for rockery, vertical stand

Vertical Garden: Vertical gardens, also known as living walls or green walls, are innovative ways to incorporate plants into urban environments and enhance floriculture practices. It is a special kind of gardening suitable to small spaces, particularly for decorating the walls and roofs in various styles.

Vertical gardening in floriculture involves growing flowering plants upwards using supports, trellises, or wall-mounted systems. It is a technique used to grow and display suitable foliage plants on a vertically suspended panels. This technique enhances space efficiency, improves plant display, and increases flower production.

Classification of Vertical gardens

A. **Green façade:** The Green façade comprise of climbing plants either growing directly on a wall through their modified organ or, climbing up with the help of support such as trellis or more specially designed supporting structures.

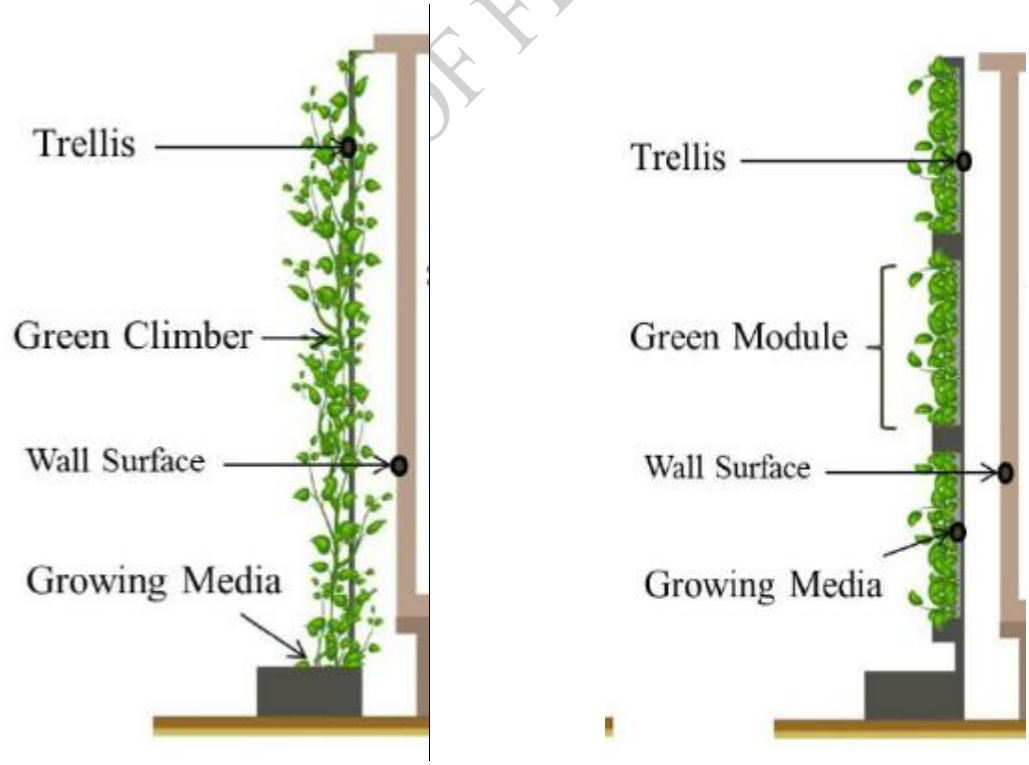

Fig: Vertical wall in a green façade (Left) and Living/ Green wall (right)

B. Living/green wall: The living/ green wall consists of the modular panel frame work often made of stainless steel, with the provision of in-built irrigation system and planters of suitable size to accommodate plants and growing medium.

✓ **Assignments:**

1. Prepare a Vertical garden for Home Garden.
2. Write the benefits of Vertical garden.

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3. Write common name and botanical name of different plants suitable for different types of Vertical gardens.

S .No	Common name	Botanical name
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Exercise No.14

To study about different flower arrangement

Objective: To get the knowledge about different flower arrangement.

Material required: Pencil and notebook, flower vase, floral wire, oasis foam, fresh and dried flower and filler greens

(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



Different Flower arrangement

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

WESTERN FLOWER ARRANGEMENT:

- Characterized by mass of flowers and foliage
- A balanced formal style which may be for front viewing or 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

Western flower arrangement

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

Circular arrangement

✓ **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 center 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.

Triangular arrangement

✓ **Radiating arrangement**

- Has a fan-like outline.
- Line flowers or foliage's 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 foliage's to give the rounded appearance.

Radiating arrangement

✓ **Crescent arrangement**

- The overall outline is crescent / half-moon shaped.
- The curved foliage is placed to the side (usually left of the center).
- 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.

Crescent arrangement

✓ **Horizontal designs**

- he 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 1½ - 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.

Horizontal designs of flower arrangement

✓ **Hogarthian curve**

- The Hogarthian curve is a sophisticated asymmetrical design.
- It also known as “Line of Beauty” and is a Serpentine or S-shaped curve.
- 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-third 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.

Hogarthian curve

➢ **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.

Dry flower arrangement

- **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**
1	Elegant	Lilium (white)
2	Informal	Daisy (white petals with yellow centres)
3	Traditional	Rose (varying colours)
4	Unique	Sunflower
5	Simple	Tulip and Gypsophila

Types of bouquets			
1	Posy		Fan
2	Crescent bouquet		Hand-tied bouquet
3	Arm bouquet		Oval bouquet
4	Freeform/Contemporary bouquet		Heart bouquet
5	Single stem bouquet		Mixed flower bouquet
6	Pomander		Fruit bouquet

✓ **Assignments:**

1. Prepare different types of Flower arrangements.
2. Prepare different types of bouquets.

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Exercise No.15

Bonsai practicing and training

Objective: To get the knowledge about bonsai practicing and training.

Materials required: Plant Seedlings, pot, aluminium or copper wire, soil mix, watering can etc.

Selection of plants for bonsai -

The suitability of plants to develop a bonsai plant depends on various factors which are mentioned below.

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. Bone meal 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 lanceoletus*), 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 bone meal 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 that 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.

✓ **Assignments:**

1. Prepare Bonsai.
2. Write different cultural practices for bonsai making.

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