PRACTICAL MANUAL

ELE HORT 367
LANDSCAPING

INDEX
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LANDSCAPING

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CERTIFICATE

This is certifying that Mr. /Miss_____ Registration No. AW- / a student of **VI semester B.Sc. (Agri.)** has completed all the exercises successfully of the Course **ELE HORT 367 (Landscaping)** during the academic year 20 - 20

Place:
Date: -

COURSE TEACHER

Date:-

EXERCISE NO. 1
IDENTIFICATIONS AND PROPAGATION OF ANNUAL, HERBS AND SHRUBS

Annuals:-

Annuals are plants that complete their life cycle in one season or one year (eg.) Balsam and Cosmos.

- Annuals 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.
- Annuals are classified into **rainy season annuals, cool season or winter annuals and warm or summer weather annuals.**

a. **Summer annuals:-** Sowing of seeds (February –march) e.g. zinnia, kochia, portulaca, Tithonia, Gaillardia, Sunflower, Cosmos, Gompherna, Coreopsis.

b. **Rainy season annuals:-** Sowing of seeds (June- July) e.g. Balsam, cock's comb, Amaranthus, Gaillardia, Tornia, Gompherna.

c. **Winter annuals:-** Sowing of seeds (September – October) They are able to tolerate low temperature during winter. E.g. Acroclinum, Annual chrysanthemum, calendula, dahlia, cosmos, Helichrysum, Hollyhock, Ice plant.

Annuals can be used for multipurpose as here under.

1. Flower beds of simple design can be laid out on the outskirts of lawn, along the base of buildings.
2. **Certain annuals are useful as edging** (e.g. Dwarf marigold, Alyssum and Candytuft)
3. **Certain annuals are useful in hanging baskets** (eg. Petunia, Verbena and Alyssum)
4. **Certain climbing annuals are useful to cover trellis work** (e.g. Tall Nasturtium and *Cobaea scandens*)
5. **Some annuals are useful for massing in beds** (e.g., Aster, Phlox, Salvia, Zinnia and Verbena)
6. **Some annuals are useful for shady situation: -** Salvia, Cineraria.
7. **For rock garden:-** Ice plant, Nasturtium, Verbena, Phlox,
8. **For screening Purpose:-** Hollyhock, Sweet pea.
9. **For pots:-** carnation, Antirrihinum, Aster , Petunia.
10. **For peculiar shape:-** Clianthus
11. **For Dry flower:-** Statice, Helichrysum, Acroclinum, Nigella
12. Few other annuals are useful for planting in shrubberies in vacant spaces; they are Sunflower, Hollyhock, tall growing species of Amaranthus, Tithonia etc.

Hints for raising annuals (Propagation)

The seeds are sown in seed pan or raised beds.

1. Thin sowing is necessary to get good sized vigorous seedlings.
2. In the seed pan, a pot mixture consisting of two parts of well sifted soil, two parts of leaf mould and one part of sand may used. Fine seeds may be mixed with 3 to 4 parts of sand before sowing.
3. Annuals which do not stand transplanting like **Calendula** and **Antirrhinum** are sown broadcast in beds.
4. Watering the nursery may be done with rose can.
5. After the seeds germinate completely, over crowded seedlings are thinned out.
6. As transplanting often results in heavy casualities the seedlings are pricked before transplanting.
7. Pricking is the practice of transplanting young seedlings into small pots individually or in the nursery beds with richer soil giving wider space (10 to 13 cm).
8. Pricking is normally done when the seedlings have produced 2 to 4 leaves. This help to increase the fibrous root system and to develop vigorous plants.
9. One month after planting when the seedlings have produced six to eight leaves, they can be transplanted into main beds.
10. Generally a spacing of 30 X 30 cm may be given for most of the annuals.
11. Tall growing annuals like Hollyhock may be provided with stakes.
12. The terminal buds of seedlings are pinched-off after they establish and when they are about 25 to 30 cm high. This encourages lateral growth and a more bushy shape.

Biennials

Biennials are plants which grow in one season, flower, fruit and die in the next season.

1. Generally, the period of growth is 6 to 9 months.
2. Biennials are grown in the same way as annual and can be used similarly.
3. Examples of biennials are canterburry bulb, *Gladiolus* etc.
4. **Herbaceous perennials**
   Herbaceous perennials are those perennial plants with soft succulent stems (as compared to shrubs which have woody stems).
5. They are propagated by **seeds, cuttings, offset and slips.** They are useful as herbaceous or mixed borders or for pot culture

The following are the examples for herbaceous perennials.

1. Chrysanthemum: Flowers are single or double available in attractive colours. Perennial species include *C. frutescens* and *C. maximum* and its varieties. Propagated easily by **suckers.**

2. *Solidago:* Popularly known as 'golden rods' producing erect feathery rod-like trusses crowded with pretty golden yellow flowers. They are suitable for mass planting in beds and borders in and adjoining lawn. They are raised by **suckers.**

3. *Gerbera:* Stemless perennial herbs with radical stalked leaves, flower heads are solitary, large and sterile with varying colours. Propagation by **division of clumps** or from seed.

4. *Gazania splendens:* Perennial plant about 20 cm high, with pointed leaves with silver, and bearing beautiful daisy like flowers, in yellow orange shades; useful in beds, borders for edging and carpet bedding and on rockeries, propagated by **seed or suckers.**

5. *Perstemon*: It has a large erect spikes of tubular, open-mouthed, gloxinia - like flowers, which are available in several shades of colours, a good bedding plant, propagated by **seeds, cuttings or division**.

6. *Pelargoniums*: It is commonly known as geraniums, a popular herbaceous perennial pot plants grown for the beauty of their flowers which are borne in large trusses propagated by **cuttings or from seed.**

ANNUAL

Sr. No.	Common Name	Botanical Name	Family	Flower colour	Flowering Season	Remarks
1	Aster	*Callistephus chinensis*	Compositae	Blue, Pink, White	Winter	Bedding, pot culture and a good cut flower
2	Calendula	*Calendula officinalls*	Compositae	Orange	Winter	Bedding, pot culture and a good cut flower
3	Hollyhock	*Althea rosea*	Malvaceae	White, Pink, red, crimson, yeilow	Winter	Screening purpose as a background border
4	Annual chrysanthemum	*Chrysanthemum coronarium*	Compositae	White and yellow	Winter	Bedding purpose
5	Cosmos	*Cosmosbipinatus*	Compositae	White, pink, yellow	Throughout the year	Bedding purpose
6	Cock's comb	*Celosiaargentea*	Amaranthacea	Yellow, orange, red	Throughout the year	Beds and border
7	Dahlia	*Dahliavariabilis*	Compositae	White, pink, yellow, orange	Throughout the year	Suitable pots, beds, rockery and cut flower
8	Carnation	*Dianthus caryophyllus*	Caryophyllaceae	White, pink, yellow, orange, purple	Throughout the year	Cut flowers, beds and borders
9	Petunia	*Petunia hybrid*	Solanaceae	White, pink, yellow, blue	Winter	Pots, beds and hanging baskets
10	Phlox	*Phlox drummendii*	Polemoniaceae	White, pink, yellow, blue, cream	Winter	Beds, borders and window boxes
11	African marigold	*Tagetes erecta*	Compositae	Yellow, orange, blue, white	Throughout the year	Cut flowers, beds and borders
12	French marigold	*Tagetes patula*	Compositae	Yellow, orange, red	Throughout the year	Bedding and pot culture
13	Mexican sunflower	*Tithonia rotundifolia*	Compositae	Orange	Throughout the year	Bedding, pot culture and a good cut flower
14	Gailliardia	*Gailliardia pulchella*	Compositae	Yellow, Orange	Throughout the year	Bedding, pot culture and a good cut

						flower
15	Bachelor's buttons	*Gomphrena globosa*	Amaranthaceae	White, Pink, purple	Summer and rains'	Screening purpose as a background border
16	Zinnia	*Zinnia elegance*	Composlitae	White, pink, yellow, orange and red	Summer and rainy	Bedding purpose
17	Sadaphuli/ Periwinkle	*Vinca rosea*	Apocynaceae	Purple, White	Throughout the year	Bedding Purpose
18	Salvia red	*Salvia splendens*	Labiatae	Red	Throughout the year	Bedding Purpose
19	Floss flower	*Ageratum mexicanum*	Compositae	Pale lavender	Throughout the year	For edging and flower bed
20	Sweet alyssum	*Alyssum maritimum*	Cruciferae	White, rose pink, lilac	Kharif	Flower beds
21	Antirrhinum/ Snap dragon	*Antirrhinum majus*	Scrophulariaceae	Various colours	Winter	Flower beds
22	Amaranth	*Amaranthus caudatus*	Amaranthaceae	White, pale green, crimson	Kharif	Flower bed
23	Tick-seed / Calliopsis	*Coreopsis drummendii*	Compositae	Yellow, crimson, brown	Throughout the year	Flower beds
24	Foxglove	*Digitalis purpurea*	Compositae	White, apricot, crimson	Kharif (July-August)	Flower beds
25	Treasure flower/ Gazania	*Gazania splendens*	Compositae	Pink, orange, yellow, red	Winter/ Summer	Flower bed
26	Sunflower	*Helianthus annuus*	Compositae	Yellow	Kharif	Flower bed
27	Strawflower / Helichrysum	*Helichrysum bracteatum*	Compositae	Silvery white to rich yellow	Kharif (August-September)	Flower bed / dry flower
28	Balsam	*Impatiens balsamina*	Baisaminaceae	Rose, pink, violet	Kharif	Flower bed
29	Statice	*Limonium sinuatum*	Plumbaginaceae	Rose, mauve, lavender	Kharif/ winter	Flower bed/ dry flower
30	Viola	*Viola cornuta*	Violaceae	Various colours	Winter	Flower beds and edging

Identification of seasonal Annuals



Zinnia elegance



Vinca rosea* (Periwinkle)** ***Salvia splendens ***Ageratum mexicanum* (Floss flower)**



Alyssum maritimum ***Antirrhinum majus*** ***Amaranthus caudatus***



Coreopsis drummondii *Digitalis purpurea* *Gazania splendus*

Helichrysum bracteatum (Straw flower)

Impatiens balsamina

Limonium sinuatum (Statice)

Viola cornuta

SHRUBS

- **Shrubs are defined as woody or semi woody perennial plants, the branches of which arise from the base of the plant and grow up to a height ranging from 50 cm to 4 m**.
- Shrubs are plants with woody stems which are smaller than trees but bigger than herbaceous plants.
- A typical shrub will have several stems arising from the main stem at ground level itself.
- They can be either evergreen or deciduous.
- Some are attractive in their foliage, some produce attractive flowers and some are grown for their attractive berries.
- Shrubs are planted at the corners of lawn in a curving line.
- **A shrubbery is an area planted with different kinds of shrubs and a shrub border is one where only one kind of shrub is used**.
- Shrubs that stand frequent pruning and trimming can be used for topiary work.
- Tall growing shrubs can be used to screen the disagreeable object and backyard.
- Handsome shrubs can make attractive pot plants for indoor and outdoor decoration.

Importance of shrubs in garden

1. Being permanent, they form part of the frame work of the garden.
2. They form the chief features of landscape gardenings placed in front of tall trees and joining the spacious lawn etc.
3. Shrubs which are amenable for frequent training are chosen for topiary work
4. Tall growing shrubs often serve as screen
5. They are useful as a single specimen in the lawn
6. They can be trained to form standards i.e., trained to single stem and allowed to branch out and form a handsome head only above a particular height e.g. Bougainvillea, Ixora, *Murrya exotica*.
7. Flowering can be seen throughout the year from one or other plant.
8. They can be used as a hedge, fencing and also for topiary e.g. Hibiscus, Thevitia, Casuarina etc.,
9. They can also be grown as potted plants

Classification

I. Based on the use in the garden

a) Shrubs for showy or attractive flowers e.g. Hibiscus, Ixora, Mussanda, Night queen, Euphorbia etc.,

b) Shrubs for fragrance e.g. Jasmine, Rose Coronaria), (Nytanthes arbotristis) etc.,

c) Shrubs for foliage e.g. Crotons, Polycias, Eranthemum, Graptophyllum etc.

d) Shrubs for attractive berries:-These shrubs produce attractive berries eg. Durantha plumieri, Cotoneaster, Carissa carandas, Rauwolfia canescens.

II. Based on sunlight requirement

a) Open sunlight e.g. Hibiscus, Bougainvillea etc.,

b) Partial sunlight e.g. Eranthemum, Polyscias, Pisonia, Graptophyllum etc.,

c) Full shade e.g. Polyscias

Shrubs in the garden are planted in the following ways (Way of planting)

1. Specimen shrubs

These shrubs are planted singly or in group in the beds on the lawn to create a picturesque effect. These shrubs produce beautiful flowers..

Suitable shrubs are: Bougainvillea, Hibiscus rosa-sinensis, Hamelia patens, Thevetia peruviana, etc

2. Standard shrub

Any shrub can be trained as standard shrub. In case of full standard shrub, main stem is clean upto 100 cm whereas in half standard shrub stem is clean upto 50cm.

3. Shrubbery border

The area of the garden devoted exclusively to shrubs is called as shrubbery border. In the garden, to secure privacy and provide partition, formal hedges are used.

Propagation of shrubs

The shrubs are propagated by seeds, cuttings and layering.

By seeds: Seeds are collected when they are fully ripe.

- They are dried in the shade and stored in airtight bottles in dry places
- The shrubs which are mainly propagated by seeds are : Stenolobium stans, Thevetia peruviana, Caesalpinia pulcherrima.

By cuttings: Majority of the shrubs are propagated by cuttings.

- The best season for propagation by cuttings is rainy season.
- The cuttings are made 15-20 cm long and planted in pots or beds containing ample of sand.

The shrubs propagated by cuttings are : Hibiscus rosa-sinensis, Jasminum sambac, Hamelia patens, Bougainvillea, Cestrum dirumum, cestrum nocturnum, etc.

By layering. The shrubs which are not easily propagated by seeds or cuttings are propagated by this method.

- In rainy season, layering is done.
- removing the bark of 2.5-3.0 cm long and wrapping, by garden soil and sand mixture or sphagnum moss.

The shrubs like Bougainvillea, lxora sp, Jasminum samba.c and Jasminum multiflorum (ground layering) etc. are propagated by layering.

Planting of shrubs

1. The best planting season of shrubs is rainy season.
2. After the onset of monsoon, planting can be done.
3. Planting can also be done successfully in the month of February-March depending upon the water facilities during summer months.
4. The planting distance of different shrubs is variable according to their height and spread.
5. The tall shrubs may be planted at the distance of 150-180 cm.
6. In very large shrubbery two or more shrubs may be planted in groups for better results.
7. The medium shrubs should be planted in one or more lines between tall and dwarf shrubs.
8. They are planted at a distance of 90-120 cm.
9. The dwarf shrubs in front line should be planted at least 30 cm away from the inner edge

Watering

Immediately after planting, watering should be done frequently till they are established.

Filling of gaps

Newly planted shrubberies need attention in the beginning specially for filling the gaps. As soon as mortality occurs, new plants should be planted.

Irrigation

The shrubbery should be irrigated at regular intervals. Frequency of irrigation depends upon soil texture, season etc. During rainy season no irrigation is required. after that. irrigation should be done at fortnightly intervals. In sandy soils, more frequent irrigation may be required.

Weeding

Weeds should be removed regularly otherwise they compete with main plants for nutrients and moisture etc. During rainy season, one or two weedings are necessary and after that occasional weeding will serve the purpose.

Pruning of established shrubs.

Shrubs need-careful pruning. Winter flowering shrubs e.g.Poinsettia pulcherrima, Holmskioldia sp., and Doembeya sp. are pruned in summer season whereas others are pruned at the close of winter season. Trimming and method of their pruning depend upon the form and age.

HEDGES

- **When shrub is planted on boundary for fencing is called as hedge.**
- For several reasons a garden should be enclosed by a good hedge or fence.
- It provides protection from cattle, shelter from wind and privacy.
- **The best plant material should have:**

1. Quick growing

2. Hardy shrub with attractive foliage
3. Handsome flowers
4. Drought resistant
5. Stand trimming to shape
6. Capable of being quickly and easily raised from seed or from cuttings to fill up the gaps promptly.

Therefore according to purpose hedges can be classified as

1. **Tall protective hedges :-** Height is about 1-3m and growth is very dense along with thrones. e.g. Bougainvillea sp, Acacia farnesiana , Carissa carandas, Inga dulcis.

2. **Dwarf protective hedges :-** Grows about 1m and have thrones and are protective in nature e.g. Opentia sp., Agave sp., Pedilanthus sp.
3. **Tall Ornamental hedges** :- Shrubs grow 1-3m tall and have attractive foliage. Plants produce colourful flowers also. E.g. Duranta plumieri , Hamelia patens, Hibiscus rosasinensis, Cesalpinia, Pulcherima.
4. **Dwarf Ornamental hedges** :- Grows about 1m and plants are very attractive e.g. Acalypha sp, Lantana camera, Eranthemum sp, Arali

Plants suitable for ornamental internal hedges :-

Acalypha sp., Barleria sp., Bougainvillea sp., Cupressus macrocarpa Duranta plumieri ,Eranthemum sp. , Hamelia patens , Hibiscus rosa- sinensis ,Lantana camera ,Malpighia coccigera ,Meyenia erecta Pedilanthus tithymaloides.

Plants suitable for boundary or tall hedges :-

Acacia farnesiana , Acaly , Agave Americana ,Aralia ,Bougainvillea ,Cesalpinia pulcherrima ,Casuarina equisetifolia ,Carissa carandus Pitheceiobium dulce ,Punica granatum , Tecoma stans ,Thevetia nereifolia

EDGES:-

When low growing plants are grown on the border of plot they are called as edge plants.

1. They are hardy grow up to the height 20-30 cm
2. Good edge plant is good self supporting, tidy and compact.
3. Most widely used:- Alternanthra, Justica , eupatorium, Irisine, Sunrose.

Ornamental and flowering Shrubs

Common name	Botanical name	Colour of flowers	Propagation
Chinese lantern MUKI JASWAND	*Abutilon striatum*	Red orange	By seeds or cuttings
Green chafa	*Artabotrys odoratissimus*	Greenish yellow	Seeds and layer
Kanchan	*Bauhinia purpurea*	Purple pink creamy	Seed layer
Bougainvillea	*Bougainvillea glabra*	All colours	HW cutting air layer
SHANKUSUR (Peacock flower)	*Ceasalpinia pulcherrima*	Yellow, orange Red	Seed
Powder puff	*Caliandra hybrida*	Red, pink	Seed
Bottle brush	*Callistemon lanceolats*	Red	Seed air layer
Yellow cassia	*Cassia biflora*	Yellow	Seed
Queen of night / RAT-KI-RANI	*Cestrum nocturnum*	Creamy Greenish yellow	Cuttings
Day jasmine, Din ka Raja	*Cestrum diurnum*	Yellow, White	Seed and cutting
Allamanda	*Allamanda cathartica*	Yellow	Cutting
Duranta/pigeon berry	*Duranta plumieri*	Purple blue	Cutting/softwood
Variegated duranta	*Duranta varigata*	Purple blue	Tip cutting / softwood cutting
Golden duranta	*Duranta goldy*	Purple blue	Tip cutting / softwood cutting
Poinssetia (RAKTAPARNI)	*Euphorbia pulcherima*	Red orange	Cutting
China rose Jaswand, shoe flower	*Hibiscus rosasinensis*	Red yellow & others	Cutting layering
Ixora/Rukmani	*Ixora coccinia*	Red, pink white	Cutting air-layering
Jatropha, coral plant	*Jatropha multiphida*	Red orange	Cutting seed
Pride of India, Gulmehendi	*Lagerstroemia indica*	Pink, white, purple	Air layer seed
Lantana, (GHANERI)	*Lantana camara*	Yellow, Red, orange	Cuttings
Mehendi, Heena	*Lawsonia enermis*	White	Cuttings
Chameli	*Jasminum multiflorum*	White	Cuttings
Malti	*Jasminum officinate*	White	Cuttings
Motia/Mogra	*Jasminum Sambac*	White	Cutting
Himachampa	*Magnolia grandiflora*	White	Layers Grafting

Kamini	*Murraya exotica*	White	Seeds air layering
Mussaenda	*Mussaenada frondosa*	Yellow, white, pink	Layering
Kanner/kanher, tree of sadness/oleander	*Nerium oleander*	White, pink	Cuttings or by layering
Parijatak/Night jasmine	*Nyctanthes arbor-tristis*	White	Seed
Pentas	*Pentas lanceolata*	Pink, Purple	Softwood cutting
Plumbago/chitrak	*Plumbago auriculata*	Blue	Cutting
Periwinkle OR Sadaphuli	*Vinca rosea*	Pink, Red, Yellow, White	Seed, cutting

Foliage shrubs:-

Common name	**Botanical name**	**Colour of flower**	**Propagation**
Thuja (MORPANKHI)	*Thuja compucta*	Crimson red and brown	Seed/air layering
Acalypha (Green)	*Acalypha hispida*	Green, Maroon	Semi-hard wood cutting
Acalypha	*Acalypha wilkesiana*	Various colours	Semi-hard wood cutting
Aralia	*Aralia veitchii*	Bronze red	Semi-hard wood cutting
Croton	*Coedimum variagata*	Yellow green	Semi-hard wood cutting
Golden Duranta	*Duranta goldy*	Red	Semi-hard wood cutting/tip cutting
Dracaena	*Dracaena drumendii*	Yellow/green	Semi-hard wood cutting/tip cutting
Green dracaena	*Dracaena excelsa*	Yellow green	Semi-hard wood cutting/tip cutting
Eranthimum	*Eranthimum nervosum*	Green/Yellow/ Red	Semi-hard wood cutting/tip cutting
Pendanus (KHEVDA)	*Pendanus rosea*	Green/Yellow	Suckers
Agave	*Agave furcaria*	Green/Yellow	Suckers
Green agave	*Agave Americana*	Geen/Yellow	Suckers
Chlorophytum ribbon grass	*Chlorophytum sp.*	Yellow/White stripped	Suckers
Coleus	*Coleus sp.*	Red/orange	Softwood cutting

Date:-

EXERCISE NO. 2
IDENTIFICATIONS AND PROPAGATION OF CLIMBERS, CREEPERS AND PERENNIALS

CLIMBERS :- Climbers are defined as a plant which possesses special structures to climb over a support. **Or**

Climbers are the group of plants which have weak stems and ability to climb up the support with the help of modified organs for sun, light, and air.

Or Plants that tends to climb vertically on to support are called climbers.

- Climbers are very important ornamental plants and are commonly used on walls, arches and pergolas .
- But in cities their utility is increased for the purpose of screening the premises from adjacent houses and maintaining privacy.
- Bare walls can be most effectively decorated by growing colorful climbers.
- plant which possesses special structures to climb over a support.

These special structures may be

a. Tendrils: *Antigonon leptopus, Bigonia gracilis, pyrostegia venusta, clematis paniculata.*

b Thorns: Bougainvillea, climbing rose

C. Root and rootlets: *Campsis grandiflora, ficus repens.*

D. Sticky substances: *Ficus repens.*

- Most climbers are perennials but there are a few annuals which can be grown in pots or in hanging baskets or in low trellises e.g. Ipomoea, Thunbergia and Clitoria.
- Climbers are propagated by layers and cuttings.
- Proper training is essential for climbers to be at their best.
- Climbers which are to be trained over screens and trellises should be induced from the base of the plant to cover them completely.
- This is achieved by pinching off the terminal bud to induce lateral branching when they are about 30-40 cm high.
- In the case of climbers over arches, pergolas and trees one or two leader shoots may be trained to the top to branch out.

CREEPERS:- Creepers are plants that tends to creep or ramble over the ground or other surfaces spreading horizontally

Creepers are those plants which are unable to climb vertically on their own because of their weak stems.

Uses of climbers in garden

1. **Certain climbers are grown in gardens for their attractive foliage.** e.g. *Asparagus spregeri, Ficus repens, Hedera helix, Scindapsus aureus.*

2. **Some light climbers can be trained as 'screens' in gardens.** e. g. *Bignonia venusta, Jacquemontia violaceae, Passiflora edulis.*

3. Climbers like *Allamanda, Antigonon, Aristolochia elegans, Solanum seaforthianum* **can be used on arches, bowers and pergolas.**

4. Heavy climbers like *Bougainvillea, Scindapsus, Petrea volubilis* can be trained over strong **pergolas or on trees which look very attractive**

Classification of climbers and creepers:-

Depending upon their growing habit, vigour, duration, nature of flowering, adaption of climbing, and shad tolerance, they can be classified as…

1. Based on plant habit and vigour:-

a) Succulent climbers: Monstera, Philodendron, syngonium

b) **Light and thin stemmed climbers:** *Clitoria ternata, senecio confuses, solanum jasminiodes*

c) **Heavy ,woody climbers:** *Artabotrys, Bougainvilliea, petrea*

2. Based on longevity and nature of flowering :

a) **Annual climber:-** *Clitoria, Black eye susan*

b) **Perennial ever flowering climber***:- Alamanda cathertica,Antogonae tristellatia*

c) **Perennial seasonal flowering climber:** *catpaw climber, garlic creeper , congea tomantosa.*

d) **perennial foliage climber:** *Asperagus, monstera, vernonia.*

3. Based on adaption for climbing:-

a) **Tendril climber:-** *Antigonon leptopus, glory lily, spacy flora.*

b) **Thorny climber:-** *asperagus, bougainvillea, roses*

c) **Adventitious root climber:-** *ficus repens, philodendron, syngonium*

d) **Twinners:-** *jasmine, ipomoea*

4. Based on shade tolerance:

a) **Shade loving foliage climber:** *philodendron, scindapsus, monstera.*

b) **shade tolerant flowering climber:-** *clock vine , potato creeper, jasmins*

5. Based on the nature of floral fragrance:-

a) **Strongly scented climber:-** *jasminum spp., wisteria sinensis*

b) **Delicately scented climber:-** *Hipatage, climatis , Quisqualis indica*

Cultural hints

- It is difficult to give any general cultural hints for all the climbers as the requirements vary from genus to genus, species to species, and sometimes even from one variety to another.
- These climbers thrive well in any garden soil.
- The soil should be fertile, deep and good in water holding capacity and water drainage should be proper.

- In general, all climbers need plenty of sunshine and loamy soil with good drainage.
- For heavy climbers, pits of 75 cm x 75 cm x 75 cm.
- whereas for light climbers the pits size may be 45cm x 45 cm x 45 cm should be dug and refilled with 10-15kg of well rotten farmyard manure.

Planting season and planting

- The main planting season for evergreen climbers is July - September and February-March
- Deciduous climbers are planted during February - early March.
- The quick growing heavy climbers intended for screening are planted 3 m apart .
- lighter growth are planted 1.2 to 1.5 m apart.
  Ficus repens, planted to cover a wall, are spaced about 25

Maintenance

- After planting the climbers, regular watering, weeding and hoeing are required which should be done.
- Climbers do not grow vertically without support; therefore, they are helped to climb by tying them with strong strings or fine wires or some such support.
- In case of any mortality, the gap filling should be done.
- During subsequent years, pruning of these climbers is essential to keep them in limit and desired shape.
- General pruning consists of removal of dead wood and excessive growth.
- Heavy climbers need drastic pruning whereas light climbers require light pruning.
- Manuring once a year just before the monsoon, with F.Y.M. or stable manure, is useful.
- Application of bone meal twice during the monsoon is also beneficial.
- General care should also be taken to keep the climbers healthy and free from pests or diseases.

Sr. No.	Common name	Botanical name	Season	Colour of flowers	Propagation
1	Allamanda	*Allamanda cathartica*	Round the year	Yellow	Cutting, air layers
2	Coralvine	*Antigonan leptopus*	Round the year	Pink	Seeds and cuttings
3	Hari champa	*Artabotrys uncinatus*	July to Sept.	Yellow	Cutting
4	Asparagus	*Aspa ragus cetaceus*	April to Sept.	-	Sucker
5	WAGHNAKHI	*Bignonia gracilis*	All year	White	Cutting layers
6	Bougainvillea	*Bougainvillea glabra*	July-Sept.	All colours	Layering hard wood

					cutting
7	Clematis/CHAMELI	*Clematis paniculata*	Sept.-Oct.	White	Cutting/air layering

Sr. No.	Common name	Botanical name	Season	Colour of flowers	Propagation
8	Railway creeper	*Ipomoea cairica*	All year round	Purple	Suckers/soft wood cutting
9	JUI	*Jasminum auriculatum*	July-Sept.	White	Layering
10	JAI	*Jasminum grandiflora*	July-Sept.	White	Cutting seed layer
11	Passion flower KRISHNAKAMAL	*Passiflora edulis*	Sept.-Nov.	White/Purple blue	Cutting seed layer
12	KRISHNAKA MAL, Watch flower	*Passiflora caerulea*	Sept.-Nov.	Red/Purple	Seed, cutting layer
13	Money plant	*Scindapsus aureus*	All year round	-	Vine cutting
14	Golden shower SANKRANTWEL	*Pyrostegia Venusta*	January-February	Orange/ Golden yellow	Air layer, cutting
15	Rangoon creeper	*Quisqualis indica*	All year round	Red, white, pink	Cutting, air layering
16	Tecoma	*Tecoma redicans*	July-Sept.	Orange/red	Cutting, layering
17	Monstera (Foliage)	*Monstera deliciosa*	July-Sept.	Green foliage	Cutting

TREES:-

Definition: Trees are a group of plants with woody self-supporting stems and a crown of foliage.

Utility and place in garden:

1. Trees are woody plants with a distinct stem with a crown of foliage the trees can support by themselves. The main stem which supports the tree is called as bone. Trees are an essential feature of landscape garden. Trees can be used as ornamental flowering trees, for garden parks, urban and rural beautification. The flowering trees like *Spathodia companulata*, *Casia fistula*, *Tabebuia spectabilis*, *Delonix regia* can adorn the gardens, parks and industrial gardens with their beautiful flowers. These trees can be used for roadside planting for urban beautification. Some trees give dense shade which can be used for giving shade along roadside

also can be planted in grooves in the city parks children parks and big gardens. The trees also play a significant role in controlling air pollution therefore, in the industrial gardens; factory gardens the foliage trees which absorb noxious gases are essentially planted. They are also planted along the roadside in the cities for checking air pollution from vehicles.

2. Some trees bearing scented flowers ex. *Cestrum diurnum, Michelia champaka, Cauroupitta guianensis, Millingtonia hortensis* can be planted in the gardens which fill in the air with fragrance. Some trees are bearing edible fruits like *Mangifera indica, Psidum guajava, Cocos nucifera,* etc. can be planted in kitchen gardens. Trees can be planted as shelter belts or wind breaks in industrial zones to check air pollution and protect from adverse climate ex Eucalyptus casurina, silver oak, Ashoka, Fir etc. the trees can be planted as ornamental specimen trees ex. *Araucaria cooci, Thuja compacta, Polyalthia longifolia* in the gardens or in lawns.

3. The shade trees which provide dense shade like *Azadirecta indica, Tamarindus indica, Ficus bengalensis, Ficus bengamina, Ficus religiosa, Dalbergia sissoo, Mangifera indica* are extensively planted as road avenue along the National highways and Grand trunk roads as well as on the approach roads and city link roads for providing shade and shelter for the passers.

Classification of trees according to uses

1. **Shade trees** : *Ficus bengalensis, Samania saman, Mimusops elengi*

2. **Ornamental foliage tree** : *Filicium decipience, araucaria cookii*

3. **Road avenue trees**: *Ficus bengalensis, Samania saman, Mimusops elengi, Tamrindus indica, Albizzia lebbek*

4. **Ornamental flowering trees** : *Peltophorum ferrugenium, Callistemon lanceolatus, Cassia fistula*

5. **Shelter belts/ wind breaks**: *Casurina equisetifolia, Grevilia robusta, Eucalyptus spp.*

6. **Trees for fruits :** *Mangifera indica, Manilkara acras, Punica granatum*

A] Flowering Trees

Botanical name	Common name	Colour of flower	Season	Propagation
Bauhinia purpurea	Kanchan	Purple, pink	September-January	Seed / air layering
Butea monosperma	Flame of forest / Palas	Orange	January- March	Seed
Callistemon	Bottle brush	Red / scarlet	June-January	Seed / air

lanceolatus				layering
Cassia siamea	Kashid	Yellow	All year round	Seed
Cassia javanica	Pink cassia	Pink	June- October	Seed
Cassia fistula	Amalthas / Bahava / Golden shower	Yellow	January- May	Seed
Cassia renigera	Pink cassia	Pink	June- October	Seed
Bombax malbaricum	Salmali / Simal	Crimson red	January- February	Seed and cutting
Cordia sebestina	Wild bhokar	Orange or scarlate	June- October	Seed and sucker
Cauroupitta guianensis	Cannon ball / Kailashpati	Yellow cream	September- January	Seed
Delonix regia	Gulmohar	Orange / Red	February- May	Seed
Ervthrina indica	Pangara	Orange/ Red	February- May	Seed and cutting
Jacaranda mimosaefolia	Nil mohar / Jacaranda	Blue	July- October	Seed
Michelia champaca	Champaca / Sonchafa	Golden yellow	July- October	Seed / air layering
Millingtonia hortensis	Indian cork tree/ Buch tree	White	July- October	Seed/root sucker
Peltophorum ferruginium	Copper pod tree	Yellow	July- October	Seed
Plumeria alba	Temple tree / White chafa	White	July- October	Seed and cutting
Plumeria rubra	Temple tree/ Pink chafa	Pink	July - October	Seed and layerin
Spathodia companulata	Fountain tree / Indian Tulip tree / Syringe tree	Scarlet Orange	July- October	Seed
Sesbania grandiflora	Hadga	Cream white	July- October	Seed and cutting
Tabebuia spectabitis	Tabebuia	Yellow	January- March	Seed
Thespesia populnea	Ranpimpal / Bhendi	Yellow turning purple	All year round	Seed and cutting

B] Shade Trees

Botanical name	Common name	Propagation	Uses
Acacia Arabica	Babhul	Seed	Shade, road avenue
Albizzia lebbek	Shrish	Seed	Shade, road avenue
Albizzia procera	Whitre shirish	Seed	Shade, road avenue
Azadirachta indica	Neem	Seed	Shade, road avenue
Ficus bengalensis	Wad/ banyan	Seed and cuttings	Shade, road avenue

Ficus benjamina	Pimparni	Seed and cuttings	Shade, road avenue
Ficus religiosa	Pimpal	Seed or cuttings	Shade, road avenue
Ficus glomerata	Umbar	Seed or cutting	Shade, road avenue
Ficus elastica	Rubber plants	Seed cutting or layering	Shade, road avenue
Ficus retusa	Wad / Chilkhan	Seed cutting or layering	Shade, road avenue
Anthocephalus cadamba	Kadamba	Seed cutting or layering	Shade, road avenue
Filicium decipiens	Filicium	Seed or cutting	Ornamental foliage
Grevillea robusta	Sliver oak	Seed cutting	Ornamental foliage
Juniperus roxburghii	Juniper	Seed and layering	Ornamental foliage
Kigelia pinnata	Monkey bread / puzzle	Seed	Shade, road avenue
Dalbergia sisoo	Sissoo	Seed	Shade, road avenue
Samania saman or Pithecolobium saman	Rain tree	Seed	Shade, road avenue
Pongamia glabra	Karanj	Seed	Shade, road avenue
Putranjiva roxburghii	Shatputri	Seed	Ornamental foliage
Terminalia catappa	Wild almond	Seed or cutting	Shade, road avenue
Thuja occidentalis	Thuja	Seed	Ornamental foliage
Tamrindus indica	Tamarind	Seed and layering	Shade, road avenue
Terminalia arjuna	Arjun	Seed softwood grafting	Shade, road avenue
Parkia roxburghii	Parkia	Seed	Ornamental foliage
Mimusops elengi	Bakul	Seed	Shade, road avenue

C] Ornamental Trees

Botanical name	Common name	Propagation	Uses
Araucaria cooki	X' mas tree	Seed/ air layering	Ornamental foliage and specimen tree
Eucalyptus comandulensis	Nilgiri/ eucalyptus	Seed	Ornamental shelter belt
Casurina equisettifolia	Casurina	Seed	Ornamental shelter belt/ topiary
Grevillea robusta	Silver oak	Seed	Ornamental foliage road avenue
Ficus elastic	Ornamental Rubber tree	Seed	Ornamental foliage, Shade, road avenue

Polyalthia longifolia	Ashoka	Seed	Ornamental foliage specimen road side
Polyalthia longifolia (Pendula)	Drooping Ashoka	Seed	Ornamental foliage specimen road side
Saraca indica	Seeta Ashok	Seed	Ornamental foliage specimen
Putranjiva roxburghii	Putrangiva (Shatputri)	Seed	Ornamental foliage specimen
Mimusops elengi	Bakul	Seed/ air layering	Ornamental foliage and specimen
Filicium decipiens	Tree fern/ Filicium	Seed	Ornamental foliage specimen road side
Diospyros melanoxylon	Tembhurni	Seed	Ornamental foliage specimen road side
Juniperus macrocarpa	Juniper	Seed	Ornamental foliage specimen
Cupressus sempervirens	Cupressus/ Cyprus	Seed and cutting	Ornamental foliage specimen
Cordia sebestena	Ornamental bhokar	Seed /cutting	Ornamental foliage
Couropita guianensis	Cannon ball tree	Seed	Ornamental flowering
Bassia actinophila	Umbrella tree	Seed / cutting	Foliage ornamental
Anthocephalus cadamba	Kadamba	Seed/ cutting	Ornamental foliage
Oreodaxa regia	Royal palm	Seed	Ornamental foliage

Date:-

EXERCISE NO. 3
IDENTIFICATIONS AND PROPAGATION PALMS, FERNS, GRASSES, CACTI AND SUCCULENTS

A. PALMS

Palms mostly found in the tropics, belonging to the family *Palmaceae.* Plants in this group are most striking, usually having straight unbranched cylindrical or columnar trunks at the end of which there is a spreading canopy of huge pinnate or digitate leaves distinguishing the group from almost all other forms of vegetation. The great botanist, Linnaeus, called them **"princes of the vegetable kingdom".** Some palms throw suckers from ground level, while a few others are huge climbers ***(Calamus)***. Ornamentally, many of the palms are very useful for decorative purposes and no modern garden is complete without their collection. The easy cultivation of palms and their delightful appearance make them great favourites in the gardens.

Utility

Palms are useful for decorating the entrance of a house, the veranda, the landings of staircases, for display in shade gardens, and for growing in the conservatory. Some of the species, though slow-growing, are excellent for avenue planting (e.g., the **Royal Palm**). Palms are very useful as potted plants and are widely used for decoration purposes.

Propagation

Most of the palms are propagated from seeds. A few others. such as ***Rhapis*** **sp.** produce suckers from the ground level and can be propagated by division of the clumps. The size of the seed may vary from the size of a pea to that of a coconut or even larger in some kinds. seeds take a long time to germinate and it may not be a surprise if some germinate one year after sowing. Therefore, pans in which palm seeds have been sown should not be disturbed for a long time even if there is no immediate germination. The hardest seeds may be soaked for a couple of hours in water a little below the boiling point to soften the seed coat before germination. The stratification method suggested for some hard coated seeds if these do not germinate properly. The compost for sowing consists of 2 parts garden loam and 1 part silver sand. The pans should have a good drainage as the seeds will remain in the pans for quite a long time. Seeds can be sown any time of the year, but some people prefer to sow during the spring while others during the rainy season. Sowing during the rains appears to be more reasonable in the plains of India. As soon as the first pair of leaves develop fully, the seedlings should be pricked in small pots of a size sufficient to hold the roots and the seed and never in oversized pots. As the palms grow they are transplanted to slightly bigger pots holding

Cultural hints

Palms are more or less easy to cultivate. In the plains of India, most of the palms will grow better inside conservatories than in the open. These can be kept under the shade of trees also. In the hills, these should preferably be grown under glass. In the

but more on account of frost. Proper precautionary measures, such as providing shade and humidity during the summer and shelter during the winter, should be taken.

Planting (Potting & Repotting)

The most important point to be remembered in pot culture of palms is that they like restricted root-room, i.e., they prefer to be pot-bound. The palms should never be repotted until the roots are overcrowded and matted near the base and when it would appear as if the roots are about to break the pot. At this time the palm is repotted without disturbing the ball of earth. The crocks are removed and the palm, with the ball of earth intact, is inserted in the next bigger size of pot which will hold about 5 cm more of soil around the ball of earth. The base of plant (collar) from where the roots emerge should just rest on the surface of the soil. A deeper planting would be harmful. Care should be taken not to injure any roots at transplanting as this may be fatal. Once repotted in this manner it will not be necessary to transplant again at least for two years.

The compost for potting consists of 2 parts good garden soil, 2 parts leaf-mould, 1 part well-decayed cow dung manure, and half to one part sand. Proper drainage material should be provided at the bottom. Transplanting should preferably be done during the rainy season. The foliage remains shining and green if the plants are fed with liquid manure prepared by fermenting oil cake and diluting the same to tea colour and applied once in fifteen days. The feeding may be alternated with a solution prepared by dissolving about 30 gm of ammonium sulphate in one litre of water. The quantity needed will depend upon the size of the plant.

Palms make quick growth in a warm humid atmosphere as the coastal regions. In mild climatic conditions, the growth is slow. In hot places syringing the foliage with water is beneficial. Palms like a liberal supply of water provided the drainage is good. It is difficult to revive a palm which has suffered injury due to lack of water supply. Many palms are likely to be injured by frost while some are quite hardy.

The palms are classified into (a) feather-leaved and (b) fan-leaved. The more important
species are listed below.

(a) Feather-leaved

Areca lutescens (Chrysalidocarpus lutescens) - Yellow palm
Caryota mita - Fish tail palm
Roystonia regia - Bottle palm / royal palm
Ptychosperma magarthuri - Cluster palm

(b) **Fan-leaved**

Livistonia sp
Pritchardia grandis
Thrinax sp

Examples

PALMS (FAN LEAVED PALMS)

Borassus flabellifer	*Chamaerops excels*	*Chamaerops humilis*	*Coccothrinax*
Corypha umbraculifera	*Hyphaene thebaica*	*Latania commersonii*	*Latania verschaffeltii*
Licuala peltata	*Licuala spinosa*	*Livistona*	*Pritchardia filifera*
Raphis excels	*Raphis humilis*	*Sabal adansonii*	*Thrinax argentea*
Corypha australis	*Licuala grandis*	*Pritchardia pacifica*	*Washingtonia filifera*

PALMS (FEATHER LEAVED PALMS)

Acanthophoenix crinite	*Areca catechu*	*Areca lutescens*	*Bentinckia nicobarica*
Calyptrocalyx spicatus	*Caryota mitis* Fish Tail Palm	*Caryotaurens*	*Cocos nucifera*
Dictyosperma album	*Dypsis madagascariensis*	*Elaeis guineensis*	*Geonoma gracilis*
Hyophorbe verschaffeltii	*Howea fosteriana Kentia palm*	*Phoenix dactylifera*	*Phoenix reclinata*
Phoenix sylvestris	*Pinanga kuhlii*	*Roystonea oleracea*	*Roystonea regia*
Calamus linden	*Cyrtostachys lakka*	*Hyophorbe lagenicaulis*	*Phoenix rupicola*

Some common plants are as follows

Common name	**Botanical name**	**Origin**	**Salient Features**
Windmill palm	*Chamaerops excels*	China and japan	Fan shaped leaves
Wine palm	*Caryota urens*	Malaysia and India	Feather leaved
Bottle palm	*Hyphorbe Langenicaulis*	Mauritius	Bottle shaped near the base
Chinese fan palm	*Livisstonia chinensis*	Malaysia	Leaves are kidney shaped
Coconut palm	*Cocus nucifera*		Yellow, green or red fruits
Fishtail palm	*Caryota mitis*	Burma malaysia	Leaflets fishtail shaped
Date palm	*Phoenix canariensis*		Slow growing and feather leaves
Mexican blue palm	*Brahea armata*	-	-
Parlor palm	*Chamaedorea elegans*	Bourbon Islands	Stems are slender and golden yellow in colour
Rattan palm	*Conecalamus Proctorii*	Malaysia	Stems and leafstalk are spiny
Sealing wax palm	*Cryptostachys renda*	Borneo	Leaf sheath is bright red and spine less stem
Silver palm	*Coccothrinax proctorii*	-	-
Sugar palm	*Arenga Pinnata*	Malaysia	Leaves silvery or white beneath
Talipot palm	*Coryphanum braculifera*	India and srilanka	Fan shaped leaves

B. CYCADS

In the tropics of the Indian plains it is not possible to grow most of the conifers, excepting a few species. Most of these grow well only in the hills while some others do quite well in a mild climate as that of Bangalore. For example, the tree ***Araucaria*** grows quitc well in plains and mild climate like Bangalore and also in many other places such as Calcutta and even in Delhi, but in the latter place mostly as a pot plant. Some ornamental plants which are allied to *Coniferae* in their fructification. Some of these plants which are very beautiful ornamentals are grown in the gardens of the tropics and subtropics. They look like palms but have no botanical relationship with them. These plants belong to *Cycadaceae* and hence are commonly referred to as Cycads.

The general cultivation of cycads is similar to that of palms and similar types of soil and climate will suit them. Many people commonly refer to them as palms of various kinds but as already stated these plants have nothing in common with palms except the general habit of growth.

Most of the plants in this group are slow in growth and prefer partial shade for their growth in the tropics, while in the hills these may have to be grown under glass. They are suitable for planting in ground or as pot plants. The long lasting ornamental leaves are used for table decoration and in many countries these are used for religious ceremonies and for decorating temples and altars. Many plants of this group are injured by frost but most often recover from such shock.

The propagation is chiefly from seeds, which remain viable for a month or so after ripening but should preferably be sown within a month. Suckers are also formed occasionally and these are separated and planted.

The *Cycadaceae* has nine genera. Some species of the following genera, namely,
Cycas, Dioon, Encephalartos, Macrozamia and *Zamia* are commonly cultivated in the garden.

Cycas circinalis	*Cycas revolute*	*Cycas rumphii*	*Dioon edule*
Encephalarto scaffer	*Encephalart oshildebrandtii*	*Macrozami aspiralis*	*Zamia*
Dioon spinulosa	*Washington robusta*		

C. SUCULLENTS

The succulents are those plants which store moisture in their foliage, or in their stems or in their root stocks, which enables them live through periods of drought. The leaves of succulents are fleshy with plenty of water holding tissues; they are often reduced in size with a thick epidermis with few stomata e.g.

Common name	Botanical Name	Family	Features
Tree aeonium	*Aeonium arborium*	Crassulaceae	Muched branched shrub with maroon leaves
Canary aeonium	*Aeonium Canariense*	Crassulaceae	Leaves elongated and ovate in shape. Flowers are small and white
Velvet rose	*Aeonium holochrysum*	Crassulaceae	Older leaves are reddish in colour. Flowers small and white
Century plant	*Agave L.*	Agavaceae	Attractive succulents with thick and fleshy leaves.
Aloes	*Aloe linn*	Asphodeliaceae	Leaves are pattern with faint marking .flower are yellow
Hadjora	*Cissus Cactiformis*	Vitaceae	Stout angular stem. Flowers are greenish in colour
Desert spoon	*Dasylirion Wheeleri*	Rusaceae	Leaves are linear with marginal hooked spines. Flowers are creamy white.
Bhamas poinsettia	*Euphorbia gymnonota*	Euphorbiaceae	Leaves are rudimentary, brown flowers.
Pearl plant	*Haworthia truncata*	Asphodiliaceae	Leaves are spotted white with cushiony projection
Felt bush	*Kalenchoe beharnesis*	Asphodiliaceae	Leaves are covered with silvery gray hairs. Flowers are small and saucer shaped

D. CACTI

Cacti: True cacti are one type of Succulents and belong to the family of Cactaceae, which are perennials bearing spines cushions. The spines are also called as areoles. They can withstand draught conditions. They store water in their thick bodies and due to areoles or thorns transpiration losses are very less. **Examples:**

Botanical name	Common name	Features
Cephalocereus senilis	Old man's cactus	Plants attains heights up to 12 m & pink flower
Echinopsis multiplex	Hedgehog cactus	Plants low growing with short cylindrical or globular stem
Aporocactus sp.	Rat tail cactus	Cylindrical creeping stems and dark red coloured flowers
Ariocarpus fissuratus	Horned star cactus	Plants body is globular with yellow flower
Astrophytum asterias	Wooly star cactus	Plants have rounded stems with yellow flower
Cephalocereus cristatus	Crested old man cactus	Tall growing with rose pink coloured flowers
Selenicereus grandiflorus	Vanilla cactus	Plants are epiphytic climbing shrubs, flowers open at night &light brown coloured
Coryphantha echinus	Ball cactus	Plants have solitary globular stem and dark red coloured flower.

E. FERNS

In the vegetable kingdom, ferns are one of the oldest members along with *Cycads* and others. Among the non-flowering group of plants, ferns are undoubtedly the most ornamental and the most beautiful. Ferns have a great capacity to adapt themselves to a new place and thus add to the beauty of that place with their elegant and graceful foliage.

Botany of Ferns*:* The ferns and some fern-allies belong to the class *Pteridophyta* in the classification of the plant kingdom. The entire fern plant may be only a small hair-like prostrate stem consisting of a few moss-like leaves, or it may also be a tall tree of 24 m. Irrespective of whether the plant is a tiny or a large specimen, it is made of three general organs, namely, the root, rhizome or the stem, and the leaf which is generally referred to as frond. The rhizome in the ferns is in reality a modified stem. In the life-cycle of an individual fern plant there are two distinct phases, known as **alternation of generation**. These **two distinct** phases are represented by two separate and unlike plants.

1. The ordinary fern plant is *asexual* and is botanically a *sporophyte,* which . produces spores generally in spore cases, called *sporangia,* which are found in masses, undersurface or margin of the leaf.
2. The sexual phase or *gametophyte* in the fern develops when the spore starts germinating and is represented by a tiny, usually scale-like heart-shaped green *prothallus.* This organ bears the sexes - *antheridia* representing the male, and *archegonia* the 'female' - on the under-surface. The fertilization takes place" in the *arehegonium* and the resulting egg develops directly into a fern plant.

Propagation of Ferns*:* It has been stated earlier that spores of ferns produce new plants. But an ordinary gardener. seldom uses spores for propagation.Spores are sown in shallow pots or pans. A 10 cm deep pot should first be filled with coarse sphagnum moss to a depth of about 6 cm. Then a compost, consisting of equal parts of humus, top soil, building sand, and very finely chopped sphagnum moss, is prepared by mixing the constituents thoroughly, which is also screened. Sowing the microscopic spores uniformly over the medium..After sowing, the pans should be covered with a glass-pane and removed to a warm, shady place.

Cultural hints*:* Most of the ferns are quite hardy by nature, and given proper condition and environment for growth, are not very difficult to cultivate. The first thing that should be kept in mind is that the ferns dislike bright sunshine except in a few cases. For example, *Nephrolepsis exaltata* adapts well in the open sun. The temperature requirements of ferns depend upon the origin of the species. Ferns of the tropics like a warm humid temperature and those from the high hills or temperate regions grow best under a cool climate. It has been stated that ferns like a shady situation for their growth. But there are ferns, especially in the temperate regions, growing on cliffs, mountains or walls, which prefer to send their head (foliage) in the sun and the roots in the shade. In the tropics, ferns are always grown in shade or semi-shade. The natural choice of site for ferns will be under the shade of trees. But care must be taken to keep the ferns relatively free from the competition of the roots of large trees. This is ensured by digging around the trunk of the concerned tree to a depth and finding out relatively root-free areas where the ferns can be planted in pockets. **Eg.** *Adiantum sp, Dryopteris sp., Nephrolepis sp., Osmunda sp., Polypodium sp.*

Common name	**Botanical Name**	**Family**
Adiantum	*Adiantumes decorum*	Polypodiaceae
Alsophila	*Alsophila latebrosu*	Cyantheaceae
Aneimia	*Aneimia routundifolia*	Schizaeaceae
Aasplenium	*Asplenium bulbiferum*	Polypodiaceae
Davallia	*Davallia Solidata*	Polypodiaceae
Lygodium	*Lygodium Circinatum*	Schizaeaceae
Osmanda	*Osmunda Regalis*	Osmundaceae
Pellaea	*Pellaea falcata*	polypodiaceae
Polypodium	*polypodium*	Polypodiaceae

F. ORNAMENTAL GRASSES AND BAMBOOS

There are a number of ornamental grasses and bamboos, which are handsome in look and quite easy to cultivate, but, with the lone exception of the lawn grass, they do not generally find any place in our gardens. The main prejudice against the ornamental bamboos or grasses is that they harbour snakes. It is a fact that uncared for bamboo bushes with their overgrowths and hollow cut-stumps provide good

shelter for the reptiles. For that matter, even an unwedded shrubbery or an untrimmed hedge can also be the hiding place for snakes. A well-kept clean bamboo clump or a neat clump of ornamental grasses cannot have any room for the reptiles. Bamboos and grasses can be grown in any kind of soil in a moist but well-drained situation. There are annual ornamental grasses as well as perennial grasses including the ornamental bamboos. The annual grasses do not thrive well under the climatic conditions of the Indian plains but they do well in the hills and our emphasis will be on the perennials. Some of the ornamental annual grasses produce flowers of everlasting nature which are good for vase decoration. Many of these annuals are good as pot plants, while some are fit for the rockeries. In the list of perennial types, the ornamental bamboos are generally grown in clumps. They look particularly beautiful when planted in sloping lands above the waterline of a pool. Sometimes, bamboos are also planted along an avenue or a garden path.

A few dwarf types (e.g., *Lagurus ovatus)* grow well in pots. *The ornamental bamboos or perennial grasses* are generally hardy and can be grown in full sun or by partial shade. The propagation of these ornamentals is either from seeds or cuttings or division of the rootstocks from a clump. The planting is best done during the rains. The bamboos and perennial grasses are deep-rooted and hence a deep cultivation is beneficial. The clumps, especially of bamboos, should be divided every 2-3 years, all dead stumps should be removed and only a portion of the clump can be retained to keep then within bounds. For potted plants it will be a wise move to repot them every year and in the process all dead stumps should be removed and new compost added. Many of the bamboos, grasses, and reeds, which are naturally suited for regions around sea level, also thrive quite well, though not as good, up to an elevation of 1,500 m. Eg. *Agrotis sp,. Bambusa sp., Cymbopogan sp., Birza media*

Grasses:-

Botanical Name	**Common Name**	**Characteristics**
Agrostis stolonifera	Creeping bent grass	Bushy, tall, hardy and have creeping stolons
Arundinaria spp.	Bamboo grass	Compact growth habit, leaves variegated with light green colour.
Axonopus affins	Common carpet grass, Mat grass	Hardy, reletivaly narrow leaved and thick stemmed.
Briza media	Quaking grass	Tall and erect in habit. The flower heads are button like and attractive.
Calamagrostis acutiflora	Feather reed grass	Tall and clump forming and tolerant to water logging.
Cynadon dactylon	Bermuda /Doob grass	Grown extensively in tropics, high temperature tolerant and not cold hardy.
Phalaris arundinacea	Ribbon grass	Attain height up to one meter and above.
Zoysia japonica	Korean grass,	Most widely used grass in temperate

	Japanese grass	region.
Molina littoralis	Purple moor grass	Mound like habit and attains the height of up to 1 m and leaves are bright in colour

G.B ULBOUS PLANTS

Sr. No	Botanical name	Common name	Propagation
1	*Amaryllis*	Belladonna lily	Bulb
2	*Begonia rex*	Begonia	Bulb, fibrous roots
3	*Caladium Sp.*	Caladium	Seed
4	*Canna indica*	Canna	Rhizomes
5	*Crocus sativus*	Saffron cross	Division of rhizomes, corms
6	*Dahilia* sp.	Dahlia	Tuber
7	*Freesia* sp.	Fressia	Bulb
8	*Gladiolus* sp.	Gladiolus	Corm
9	*Gloriosa superha*	Gloriosa	Tubers
10	*Hyacinthus drientalis*	Hyacinth urn	Bulbs
11	*Iris japonica*	Iris/ Flag	Bulbs
12	*Lilium longiflorum*	Lilium	Bulbs
13	*Narcissus* sp.	Daffodil or Narcissus	Bulbs, seed/ bulb
14	*Tulipa* sp.	Tulip	Tubers
15	*Tuberose*	Tuberose	Tubers
16	*Zephyranthes* sp.	Zephyrilily	Tuber

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Date:-

EXERCISE NO. 4
PLANNING, DESIGNING AND LAYOUT OF FORMALS AND INFORMAL GARDENS

Planning provides uniform rhythm, proportion and balance in the garden style. Such gardens can be relaxing places of joy and enhance the beholders' peace of mind.

The three major factors of landscape gardening are:

- The practical consideration of the site,
- Its proposed functions and
- Personal taste of the owner and the designer.

The following factors should also be considered before planning:

- Purpose of garden
- Personal issues viz., what you have, what you need and what you like?
- How long the garden should not require redesigning?

Thorough study of the sight is essential which includes the quality and quantity of sunlight at the garden site, any permanent structure like building, effect of shade etc. The basic framework of the garden as visualized by the landscapist should be drawn on paper before resuming with the work. The position of long-term features such as patios, walls and trees should be worked out in advance. It is better to plan the garden as a whole than taking different parts separately. Planning should be a logical process to create a design that combines the functional and desirable factors in a realistic, optimistic manner.

REDESIGNING AN EXISTING GARDEN:

There are various reasons for redesigning. One may wish to change some part or the entire existing garden to suit personal preferences. The layout or characters of garden may be altered for different uses**,** such as providing play areas, space for fruits and vegetables, or greater privacy. If an existing garden has to be modified, one should precede step wise since the plan revolves around what is available and what is required.

Steps to be taken:

- Measure the area. If irregular than measure it in bits.
- Mark distinct objects to be precise.
- Mark distinct slopes.
- Mark the morning sun and other shade areas.
- Make a rough plan and get consent.
- Make a plan as per scale.
- Plan the work, construct in summer, plants and dig in rains and in winter months.

CREATING A NEW GARDEN:

It is important to design the garden in relation to its setting and to take into account some factors such as soil type, slope, weather, local planting materials, irrigation facilities, etc. It may seem simple to dig up the entire garden which has

jungle-like tangles of trees and neglected shrubs and weeds. But it is better to proceed with caution. The inclusion of one or more mature specimens in a new garden provides a framework around which to design the planting scheme and also helps to counteract raw appearance.

CONSIDERATIONS FOR GARDEN DESIGNING:

The basic considerations to be taken before developing a garden are given below:

1. **Climate:** This includes annual rainfall, relative humidity, temperatures, sunshine hours and special climatic influences on particular area. For example, town gardens are usually warmer and more sheltered all year round than those in rural areas. In addition, the microclimate should be assessed such as which parts receive sun and shade in different time of the day and of the year.
2. **Soil:** It is essential to find out characteristics of the soil which includes, type-heavy or light, texture-clay or sandy, acidic or alkaline (pH), etc. The soil types affect drainage, the type of plants that may be grown, type of irrigation and the ease of cultivation tasks such as digging and planting.
3. **Design:** When designing a garden, consider it in the context of its surrounding rather than in isolation. For example, it may be in a terrace or suburban setting with good or bad outlooks. The more detailed plan may be drawn showing view of site, direction of wind and where shelter or screening is required.
4. **Maintenance:** All gardens need some care and attention to keep them in good conditions. Before deciding a design, be realistic about the amount of work and energy required for maintenance of the garden. Also assess how much time and help will be available or affordable for different operations.
5. **Cost:** This includes all type of cost like cost of construction, cost of soil preparation and modulation, cost of irrigation system, cost of establishment of plants and their maintenance cost. During planning and designing one has to consider the expenditure of the garden as well as the budget of the owner and then planning should be carried out.

STEPS FOR CREATION OF DESIGN:

1) **Exploiting Natural Characteristics:** Always try to work with given conditions using natural features of site. Slopes, banks and changes in level may offer scope for constructing terraces, retaining walls, stepped beds, a watercourse or a rock garden. Poorly drained or damp problem areas are good for making bog or marsh gardens using moisture loving plants.
2) **Assessing Existing Features:** Make separate lists of planting material and hard elements present on the site. Note their position in the garden. When preparing garden plan, this information will be helpful to decide which element or plant to reposition or remove or modify.
3) **Measuring the Site:** First of all, measure the boundaries of the plot. If the site is irregularly shaped, divide it into small sections and measure it separately. Alternatively, a surveyor may be employed to prepare a scale plan.
4) **Making a Scale Plan:** Next step is one has to draw a scale diagram of the site as a basic plan on which various designs may be drawn. These may differ greatly in

styles; the space allocated for each feature, and the sense of proportion, but makes each one on a scale plan so that it has a realistic basis.

5) **Changes of level:** If there are marked changes of level on the site, indicate this at the survey stage, as the new design may have to incorporate certain features to accommodate the gradients. A gentle slope may keep as such for proper drainage and a steep slope may necessitate the building of terraces or retaining walls.
6) **Preparing the First Plan:** The site measurements take on paper to create a scale-based plan of the garden which should include all boundaries together with all elements which one want to retain from the existing garden. If making several different designs for comparison, draw each on tracing paper fixed over this scale plan so there is no need of redrawing.
7) **Choosing the Design Style:** There are many variations of styles that provide potential for creating a unique design but preference is given to personal taste. All the basic principles should be kept in mind, whatever may be the design. Style of the garden is also depend on position and surroundings of site.
8) **Drawing up the Final Design Plan:** Draw this working plan accurately as per the scale on paper, using numbers and symbols for various features. Also indicate the proportion and size of the feature so they may not create problems on ground.
9) **Planning the Work:** Designer has to prepare a schedule, before embarking on construction and cultivation, to minimize disruption on the site so that the messiest and most elaborate operations, such as constructing a patio or wall, are carried out first. Planting process require clear site, proper time and season for survival and establishment.
10) **Planting:** After completion of skeleton of garden means marking and development of hard elements like paths, steps, walls, etc. Planting should be carried out carefully. Growth rate and size of plant after due course of time and at maturity should be kept in mind. Old hedge or shrubs of poor condition should be removed and replanting with new should be done.

Date:

EXERCISE NO. 5
PLANNING, DESIGNING AND LAYOUT SPECIAL GARDENS.

Date:-

EXERCISE NO. 6
STUDY OF DIFFERENT POTTING MIXTURES, SOILLESS CULTURES AND PREPARATION OF POTTED PLANTS

Definition:-

The medium used to germination of seeds or rooting of cutting layers is called the propagations media. Several media and mixtures of different media used in the propagation of plants. All such media have several properties.

Properties of ideal propagation media:-

1. The medium must be sufficiently firm and dense to hold the cutting or seed in place.
2. Its volume must be firmly constant whether wet or dry.
3. It must be sufficiently retentive of moisture to avoid frequent watering.
4. It must be sufficiently porous for aeration and retention of water.
5. Free from weed seeds and diseased organisms as nematodes.
6. It should have neutral pH level suitable for the plant to be propagated.
7. It must be capable of being sterilized with steam without deleterious effect.

Following are the propagation media:-

1. **Soil: -** Soil is composed of material in solid, liquid and gaseous stages, for satisfactory plant growth. Theses material must exist in the proper proportion, solid portion of soil is composed of organic and inorganic forms. The later derived from the parent rocks after decomposition due to chemical and physical processes of weathering. Such inorganic components vary in the size from gravel to the minute colloidal particles of clay. Course size particles serve as supporting frame work. Clay particles served as store house of material which may be absorbed by plants.
2. **Sand: -** Sand consists of small rocks grains 0.05 to 2.0 mm dia. Quartz sand is generally used for propagation purposed consisting of chiefly silica complex. The type used in plastering is the grade ordinarily the most satisfactory for rooting of cutting i.e. softwood cutting, e.g. Cactus.
3. **Leaf moulds: -** It is prepared by placing alternate layers of leaves and soil to which small amount of Nitrogenous compound i.e. Ammonium sulphate is added. The mixture is watered to maintain decomposition action. The leaf mould compost is ready in 12-18 months.
4. **Sphagnum moss: -** Commercial S.M. is the dehydrated remains of acid beg plants (***Sphagnum papillosum)***. This is light sterile and having very high water holding capacity. Being able to absorb 10-20 times its weight of water by cells of stem and leaves. It contains a specific fungi static substance, which account for its ability to inhibit damping off of seedling. This Sphagnum moss is generally used for propagation of plants by air layering. The pH of moss is 3.5
5. **Vermiculite: -** This is a micaceous mineral, which expands when heated 1092^0C. Chemically, it is hydrated magnesium, aluminum, iron silicate. When expanded, it is very light in weight 128.05 to 160.00 kg per cubic meter. Neutral in reaction with good buffering properties and insoluble in water absorbs 530 lit/cubic m.
6. **Sawdust**: - This material is a byproduct of timber mills. They can be used very well in soil mixture serving much purpose in propagation. Nitrogen is added in

sufficient amount for decomposition of sawdust, additional amount of N used by plants.

7. **Water**: - The water is rarely used as propagation material. The cultivation of plants in water is termed as hydroponics.
8. **Perlite**: - This is grey white material of volcacious origin mined from lava flows. It holds water 3-4 time its weight. It is useful in increasing aeration in potting mixture.

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Date:-

EXERCISE NO. 7
MAINTENANCE AND REPAIRS OF POTTED PLANTS

A) MAINTENANCE

Watering

If you plant in the spring and the weather is mild, you can probably get away with watering about once a week. As the summer continues, plants need more water. Not only is the warm weather evaporating the moisture before the plant can use it, the plants need more water as they grow larger. Hanging plants and small pots may need watering twice a day (best times are morning and evening); once a day is enough for large pots.

Water your plants until the water comes out of the drainage holes. That way you know the soil is getting moisture all the way to the bottom.

Water the soil, not the leaves and flowers. Wetting the foliage can lead to fungal diseases and sometimes scorched spots on leaves.

Don't worry if plants and flowers look wilted in the hottest time of the day. As long as the top of the soil is moist, you probably don't need to water. Wilting is a self-protective mechanism to prevent too much moisture loss from the root area. Wait and see if the plants perk up after the sun goes down.

Don't let pots sit in water; this can cause root rot and death. If you are using saucers, empty them after you water and after it rains.

Feeding

Plants growing in containers need more fertilizing than those in the ground. The more you water, the more quickly you flush the nutrients out of the soil. It's good to use a time-release fertilizer when planting (see "Step 2: Choose the Potting Mix"), but it's the bare minimum. If you want really healthy and happy plants, feed them a liquid or water-soluble fertilizer every couple of weeks according to package directions.

Deadheading

Pinching or cutting off faded blooms, known as deadheading, is essential. It encourages a plant to keep producing more flowers.

Some plants have so many tiny flowers and stems, it would be too time-consuming to snip or pick off individual flower heads. For those types, it's best to shear the whole plant back to about one-third of its size. It will look "whacked" for about a week, but you will soon be rewarded with a flush of new buds and blooms.

Some flowering plants are "self-cleaning," meaning they don't generally require deadheading or shearing. These are usually prolific bloomers covered in smallish flowers, which just shrivel up and almost disappear on their own. Some examples are impatiens, mini petunias, diascia, and browalia. If they start to flag late in the summer, cut back the plant by one-third to rejuvenate blooming.

SUMMER CARE

Plants in containers need attention all year, but summer is the most critical period as plants can soon run short of water and nutrients and carried out mulching of plants.

WINTER CARE

In winter, the main danger is compost freezing, which may kill plants.

Frost protection

- Protect pots with bubble plastic or bring them under temporary cover
- In very wet periods move plants under temporary cover if the compost becomes sodden, until it has dried out a little. The 'rain shadow' of walls can be sufficient
- In wet weather, raise pots up off the ground on 'feet' or similar to keep the bottom of the pot out of the water
- Remove saucers in winter

PROBLEMS OF POTTED PLANTS

- Overwatering is the most common cause of loss of container plants; watering should aim to keep the compost moist, never soggy and avoid alternating dryness and saturation.
- Plants grown in containers suffer from many of the same pests and diseases as when grown in beds and borders, such as aphids, algae, liverworts and moss and scale insects. Vine weevil and fungus gnats are particularly common pests of container-grown plants.

Good Container Flowers for Sun

- Angelonia
- African daisy (*Arctotis*)
- Dahlia
- Purple fountain grass (*Pennisetum setaceum 'Rubrum'*)
- Lantana
- Verbena
- Zinnia
- Tuberous Begonia

Good Container Flowers for Shade

- Fuchsia
- Impatiens
- Browallia
- Torenia

Good, Colorful Foliage Plants for Sun and Shade

- Caladium (shade)
- Coleus (sun and shade, depending on variety)
- Phormium (full sun to part shade)
- Canna (full sun to part shade)
- Ferns (various types, filtered sun to shade)
- Persian shield (*Strobilanthes dyerianus*, full sun/part shade)

- Ornamental sweet potato vine (*Ipomoea batatas*, full sun/part shade)
- Ornamental grass (various types, full sun)

Good Container Flowers for Sun and Shade

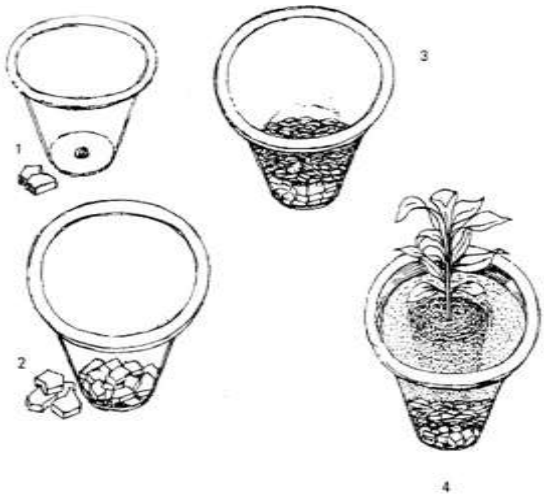
- Twinspur (*Diascia*, full sun/part shade)
- Mini petunia (*Calibrachoa*, full sun/part shade)
- Nemesia (full sun/part shade)
- Scaevola (full sun/part shade)
- Salvia (*Salvia guaranitica*, full sun/part shade)

B) REPAIRS OF POTTED PLANTS

POTTING:-

Material required: - Garden Compost, Chemicals, Spade, Pots, Shade and Leaf mould.

Procedure:-



Select well backed and sound flower pots of the proper size (the size will depend on age of the plant and purpose for which the pots are filled), Wash the pot inside and outside; with clean water. Place a large rock on the drainage hole. Now put several smaller rocks to a depth of 5 to 10 cm depending upon the size of the pot. Put 1.25 to 2.5 cm layer of coarse sand or coconut fiber. This is necessary to check the washing away of the fine soil particles. Fill the pot with soil mixture or compost. When half full, press the mixture firmly. Continue filling up to the rim of the pot. Press the potting mixture again and finally fill and press mixture to a point where a room of 2 to 3 cm is left for holding water.

For growing different types of plants in pots, different type of potting mixtures are used, and they are as follow.

1) **For potting rooted cuttings and young seedlings: -** Two parts sand, one part loam soil and one part leaf mould. (2:1:1)
2) **For fruit plants :-** One part sand, two part loam soil, one part leaf mould and one part well-rotten FYM. (1:2:1:1)
3) **For sowing seeds:** - Three parts leaf mould, one part loam soil, one part sand and half part finely powdered charcoal. (3:1:1:$^1/_2$)
4) **For planting cuttings: -** One part leaf mould, one part sand, one part loam soil. (1:1:1)
5) **For cacti :-** Loam soil two parts, leaf mould five parts, lime stone gravel one part, charcoal dust one part and sand one part. (2:5:1:1:1)

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B) REPOTTING OF PLANTS:-

Potting: - When a plant is transferred from a seed bed or a flat bed to a pot the operation is known as potting.

Repotting: - Repotting is the act of transfer of plants from one pot to another pot.

Depotting: - Removal of plants from the pot is known as depotting.

Object:-

1. Change of containers.
2. To remove the pot bound condition of the plant.
3. To change depleted or exhausted soil from pot.
4. For separation or division of plants (Bulb, Suckers, Corms, etc.).

Procedure for Repotting:-

a. Repotting should always be undertaken in the beginning of growing season (Kharif).

b. Water the plants to be repotted an hour or two prior to the operation.

c. Loosen the soil around the rim.

d. Invert the pot.

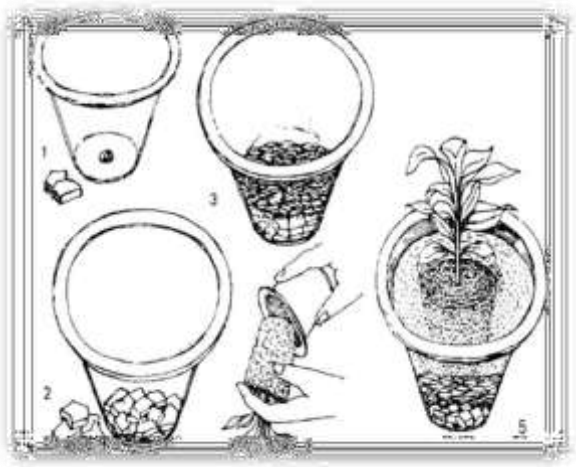
e. Keep the right hand part under the surface of the soil with the plant stem between the two middle fingers.

f. Tap the rim sharply but gently with a wooden matter as against on hard surface.

g. Take out the plant along with the root ball.

h. Remove extra soil and cut dead and disease, pest affected roots.

Depotting



i. Planting of depotted plant in another pot with fresh mixture.

j. Provide irrigation regularly.

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Date:-

EXERCISE NO. 8
PLANTING AND MAINTENANCE OF LAWN

Lawn is a basic feature for home ground development and an essential feature for any type of garden. It can be defined as the green carpet for a landscape.

Importance:

i) It improves the appearance of the house, enhances its beauty, increases, convenience and usefulness, thus adding monetary value to the real estate in home garden.
ii) It provides perfect setting for a flower bed, border, shrubbery or a specimen tree or a shrub.
iii) It has spiritual value and is an important source of charm and pride.

The view of a lawn should be uninterrupted from the house or from the entrance. If the lawn is spacious, seasonal beds, herbaceous borders, beds of canna, attractive specimen trees like *Cassia renigera*, C. fistula, Bottle brush, *Spathodia, Plumeria alba* (evergreen), *P obtuse, Tecoma argentia, etc* or shrubs such as *Araucaria cookie, Thuja, Callistemon lanceolatus, Brya ebenus*, etc., may be planted. Some bulbous plants such as *Zephyranthes, day lily, Amaryllis, Hippeastrum* may also be planted in groups in the lawn. Grass is one of the hardiest perennial herbs and it is very difficult to maintain a lawn, although one has to take the necessary care.

Site:

i) Site should receive full sunshine.
ii) Best situation will be southern side and next best is the south-east and south-west of the building.
iii) No big trees should be present at the site because the falling leaves make the lawn dirty.
iv) Soil moisture and drainage should be optimum.

Soil type:

A fertile loamy soil containing enough organic matter is best suited for lawn preparation. Depth of the soil should be 25-30 cm, pH should be around 6 to 7.

Digging:

- First make rough leveling by eye site.
- After which digging is carried out, thorough preparation of land is most essential for long time success of lawn.
- Digging is carried out by trench method. Trenches of 60 cm × 45 cm size are dug at the site.
- During digging, all stones, old masonary, grass root, etc. should be removed.
- The clods should not be left unbroken.

Time of digging: It is done in month of April or May.

Manures and fertilizers:

- 500 kg/100 m^2 of fine compost or FYM should be added to soil.
- This is then worked up in the soil to a depth of 15-20 cm, watered and leveled.
- Slopes and mounds at the site should be gradual and artistic.

Selection of grass:

Selection of grass species for lawn development:

a.) Bermuda grass (*Cynodon dactylon*):

This grass is commonly referred as *doob* grass and also known as *hariali*, *arukampillu* and *durba* in vernacular. It is very commonly used for planting lawn due to its fast growth, hardiness, less water requirement and reponse to frequent mowing. This grass makes excellent turf and is tolerant to frost.

b.) Korean grass (*Zoysia japonica*):

This grass is suitable for smaller areas and home lawns. Korean grass grows slowly and there is no requirement of frequent mowing.

c.) Kentucky blue grass (*Poa pratensis*):

This grass is of very fine texture and soft and is like carpet. It grows best in full summer.

d.) Rye grass (*Lolium perenne*) and crested dog's tail grass (*Cynosurus cristatus*): These are the cheaper species and not very fine.

e.) Wood meadow grass (*Poa nemoralis*):

This species is suitable for growing under shade.

f.) Grass suitable for temperate region:

Agrostis tenuis and *Festuca rubra* are the grass species suitable for temperate regions.

Methods of Planting:

The different methods for starting lawn are described below.

1) **Seed sowing:**

Prior to sowing, relatively dried surface area is scratched to a depth of 2.5 cm. with the help of a garden rake. Total area is divided into 200 to 300 m^2. Since the seeds of lawn grass are very light and fine so it is necessary to mix with double quantity of fine soil and seed is broadcasted @ 500g/200m^2. Then the rake is moved in the opposite direction. Then ground is rolled lightly, watering is done, seed will germinate within 3 to 5 weeks period. When grass attains a height of 5 cm, it is clipped off.

2) **Dibbling:**

After land is ready, well matured rooted or unrooted doob grass cutting is obtained from close cut lawn or nursery. Then grass is dibbled at 7-10 cm apart. After 5-7 weeks, cutting is done. Lawn is ready after 4 months.

3) **Turfing:**

It is the quickest method, but its cost is prohibitive. Turf is a piece of earth of about 5 cm thickness with grass thickly grown on it. The piece may be square, round and free from weeds. It is laid on ground closely to each other in a bounded alternate pattern, like bricks in a wall.

4) **Turf plastering:**

A paste is prepared by mixing garden soil, fresh cow dung, and water. Bits of chopped fresh grass roots and stem are mixed with this. The paste is spread uniformly on ground and covered by soil having 2 cm thickness. It is not suitable in dry and hot climates.

Maintenance of lawn:

1) **Weeding:**

All weeds should be removed with roots before flowering. Most serious weeds are Motha (*Cyperus rotundus*) and dudi. Frequency of weeding is more in rainy season compared to winter.

2) **Rolling, mowing and sweeping:**

Object of the rolling is to help grass to anchor itself securely and keep surface leveled. Mowing consists of cutting grasses at correct height with machine. Grasses should not be allowed to grow more than 5-6 cm in height. Sweeping of lawn is done thoroughly after each mowing to clean out grasses which might have fallen from mower box.

3) **Irrigation:**

Doob grass is shallow rooted and frequent light irrigations are necessary. The winter dew is important and each morning the dew should be brushed into the grass by drawing a hosepipe over the grass, before the dew evaporates.

4) **Scrapping and raking:**

Continuous rolling and mowing leads to formation of hardy crust. Therefore grass is scrapped at ground level with the help of *Khurpi* in month of April or May. Scrapping is followed by raking to break crust.

5) **Top dressing with compost and fertilizer:**

After scrapping or raking a compost consisting of good garden soil, coarse sand and leaf mould in proportion of 1 : 2 : 1 is spread over lawn to a depth of 3-5 cm. For this, 100 kg compost is required for 100 m^2 area. Single Super Phosphate is applied @ 1kg/50 m^2. Compost is also used as top dressing in month of September – October and from October–April, Urea is applied once in every month @ 500gm/50m^2.

6) **Frost injury:**

In Northern India, grasses are injured due to frost. This can be avoided to a great extent if grass is sprayed with water every evening and in early morning after frost.

Date:-

EXERCISE NO. 9
IRRIGATION AND NUTRIENT MANAGEMENT IN LANDSCAPE GARDEN

Water needs

Ideally, you should select plants that are adapted to local rainfall. Locally adapted plants will only need watering in order to get established or in times of severe drought. But it is not necessary to exclude all plants that will require regular irrigation from your design. Choose medium or low water using plants adapted to your climate and then group them in your landscape design according to their water needs (hydrozones). Medium water use plants will require less supplemental water if they are situated in low lying or slow draining areas of the landscape provided the area is protected from wind and hot sun. Select low water using perennial plants instead of annuals which have to be re-planted every year and generally require more maintenance and water

Plants for the Water-Wise Garden

Landscaping with water-wise plants (often referred to as "xeriscaping") has become popular in recent years. The word xeriscape was first coined in the early '80s by Denver Water as the need for water conservation, particularly in the landscape, became increasingly important. Xeriscape (meaning "dry landscaping") became more than just a buzzword. However it was often associated with rock, sparse landscapes, cactus and yucca, and sometimes considered just plain boring.

Landscape Irrigation

The primary goal of installing a water-wise landscape is to reduce the need for supplemental irrigation while still maintaining a healthy and attractive landscape. The water needs of the landscape are determined by the local climate, plant type, the time of year, and the desired quality of the landscape.

Good irrigation design and scheduling are essential for maximum water efficiency. Irrigation design consists of the type of sprinkler system (manual or automatic) and the layout of the sprinkler system. A properly designed and well-managed system will apply water only when it is needed and only the amount necessary to replenish the soil moisture that has been lost due to evaporation from the soil and transpiration from the plants. Important facets of landscape irrigation are described in this section:

Manual or Automatic Irrigation

There are two basic ways to water: manually (hand watering) with hoses and sprinklers or nozzles, or automatically with clock-driven, in-ground irrigation. You may decide to use manual or automatic irrigation, or a combination of both.

Automatic Irrigation Systems

Automatic sprinkler systems are more expensive to install and maintain than manual irrigation. Professional services may be required for installation and some of the maintenance. The typical home irrigation system is only about 40-50% efficient. That means that half of the water applied to the landscape is wasted and not benefiting the plants.

Manual Irrigation System

Manual irrigation is more efficient and less expensive than installing an automatic irrigation system. Very little maintenance is required and the maintenance that is necessary can easily be performed by most homeowners. Manual irrigation systems are however more time intensive than automatic irrigation

Drip Irrigation

Drip irrigation can be operated either manually or as a zone or zones on an automatic sprinkler system. Drip irrigation applies water to the root zone of the plant at low pressure and low volume, making efficient use of water. Water is delivered where plants need it–around the root zone. Because it is applied slowly on or near the ground, no water should be lost to runoff or evaporation. The amount of water delivered can be controlled by varying the length of time the system runs or the type of emitters.

Drip irrigation is easy to install, inexpensive compared to overhead sprinkler systems, and can reduce disease problems associated with high levels of moisture on some plants. Most home improvement stores carry some drip kits, but go to an irrigation supply store for advice and a full line of drip irrigation components.

Tips of Drip irrigation system

1. Drip irrigation can take the form of emitters, microsprays, or soaker hoses.
2. Drip is the preferred method of irrigating trees, shrubs, and vegetable gardens, but it is generally not recommended for continuously rooting ground covers.
3. Subsurface drip can be used to irrigate lawn areas. Emitter lines are buried 4 to 8 inches below the lawn or soil surface and are usually spaced 12 to 18 inches apart. Water from the emitter line spreads slowly through the soil to irrigate the lawn or plants.
4. Overhead irrigation systems can be converted to drip with retrofit heads.
5. Drip systems can be connected to a hose end and manually operated, or be permanently connected to your main water source and operated by an automatic controller.
6. Plan enough capacity (emitters) for when your landscape matures. Use the product's emitter selection chart to determine the flow rate and number of emitters per plant.
7. Polyethylene ("poly") tubing on the surface in areas of heavy foot traffic or children's play areas can easily be broken, disconnected, or vandalized.
8. Dogs, raccoons, gophers, and other animals can chew tubing and emitters. If this is a problem, use rigid pipe (polyvinylchloride or PVC) and protection for emitters.
9. Drip irrigation needs to be regularly maintained to check for leaks and clogged heads. Keep your system as simple as possible to lower maintenance. Half inch diameter drip line with the emitters built into the line is highly recommended to minimize maintenance.

Irrigation Scheduling

Turf grasses, annual flowers and vegetables are usually high water using plants. Turf grass is shallow rooted and fast growing and requires more frequent irrigation. Cool season grasses such as Kentucky blue grass need considerably more water than warm season grass varieties such as centipede, bermuda, or buffalo grass.

1. Ornamental shrubs and ground covers may use 40% to 60% less water than turf or annual flower beds.
2. Regionally adapted plants are often low water using plants, and may use 60-90% less water than high water use plants.
3. Drought resistant plants, including many regionally adapted and native plants, may thrive on minimal or no supplemental water. Many of these plants can survive strictly on seasonal rainfall once they are established.
4. Newly planted plants need to be watered more frequently until their root systems are established, usually 2 to 3 years, after which irrigation should be scaled back.
5. Potted or container plants dry out more quickly than those in the ground and therefore require more frequent watering.
6. Plants in full sun areas of your yard often require about 30% more water than shady areas.
7. Plants in sandy soils require shorter more frequent irrigation than clay or loam soils because of the lower water holding capacity of sandy soil.

Nutrient management

There are 16 essential nutrients required for plant growth and development. In absence of any one of these essential nutrients, plant can't complete its life cycle. The 16 essential elements are: carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), boron (B), molybdenum (Mo) and chlorine (Cl). Of these 16 elements, all except carbon, hydrogen, and oxygen are derived from the soil. Some of these nutrients viz. nitrogen, phosphorus, potassium, calcium, magnesium and sulfur are required in greater quantity and therefore, called as macronutrient. Nutrients viz. iron, copper, manganese, zinc, boron, molybdenum and

chlorine are required in relatively smaller quantity and therefore, called as micronutrients. Nutrients are required for plant in sufficient quantity and in suitable proportion for better growth and development. Nutrient deficiency can lead to poor and stunted growth of plants resulting in poor performance. Often nurserymen are encountered with some deficiency symptoms appearing in nursery plants and therefore, they should have sufficient knowledge to identify the deficiency symptoms so that corrective steps can be taken effectively.

Preparation of potting mixtures for garden pot plants

There are several potting media for growing nursery plants. To save transportation cost locally available products should be used. The potting mixture should have the following characteristics:

- ✓ It should contain sufficient organic matter to supply nutrients and to maintain optimum soil porosity for water holding and aeration.
- ✓ pH of the potting mixture should be near neutral or neutral (6.5-7.0). Acid or alkaline pH affects nutrient supply (either toxicity or deficiency) as well as microbial activity in soil.
- ✓ It should contain optimum air filled porosity for root aeration.
- ✓ It should contain sufficient drainage capacity to avoid water stagnation in container.

Most commonly used one is loam soil mixed with suitable proportion of sand and organic matter (FYM, compost, vermin-compost, leaf mold, oil cakes etc.). Ideal loam soil contains 40% sand, 40% silt and 20% clay. While preparing potting mixture 1 part of ideal loam soil is mixed with 1 part sand and 1 part compost. But, when the soil is loamy but proportion of clay is more in that case 1 part of soil is mixed with 2 parts of sand and 1 part of compost. Compost used for potting mixtures should be well decomposed. Don't mix chemical fertilizers in the potting mixtures because its direct contact with the young roots may adversely affect of garden plants.

Application of nutrients to garden plants

Direct application of chemical fertilizers in polythene bags to take care of nutrient requirements of plants is usually avoided because direct contact of fertilizer may affect the young roots of garden plants. Supply of nutrient from soil will be

adequate provided the potting mixture is rich in organic matter. Mixing of well decomposed good quality compost with potting mixture is needed to supply nutrients to the plants in sufficient quantity. Besides, to avoid nutrient deficiency foliar applications of nutrients are necessary. Foliar spray of Poly Feed (Haifa Make) or equivalent products can be used to take care of nutrient requirement of plants. Generally foliar spray of 0.5% (i.e. 0.5 g per litre of water) Poly Feed (21:21:21 with micronutrients) at 15-20 days interval is recommended to catre the needs of nutrient requirement of garden plants.

Nutrient deficiency in garden plants and their remedies

The nutrient deficiency symptoms appear in nursery plants when growing media fails to supply sufficient nutrients in suitable proportion to the plants. The deficiencies symptoms are manifested in various plant parts. The deficiency symptoms of different macro and micro elements and their corrective measures are given hereunder.

1. **Nitrogen-**Light green to yellow appearance of leaves, especially older leaves; stunted growth
2. **Phosphorus-**Leaf tips look burnt, followed by older leaves turning a dark green or reddish- purple
3. **Potassium-**Older leaves turn yellow initially around margins and die
4. **Calcium -**Reduced growth or death of growing tips; hooking of leaf tip
5. **Magnesium-**Initial yellowing of older leaves between leaf veins spreading to younger leaves, V shaped green island in chlorotic back ground
6. **Sulfur-**Initial yellowing of young leaves spreading to whole plant; similar symptoms to nitrogen deficiency but occurs on new growth.
7. **Iron-**Initial distinct yellow or white areas between veins of young leaves leading to spots of dead leaf tissue.
8. **Manganese-**Interveinal yellowing or mottling of young leaves.
9. **Zinc-**Interveinal yellowing on young leaves; reduced leaf size called “little leaf” in the terminal growth
10. **Boron-** Death of growing points and deformation of leaves with areas of discoloration.

]

Date:-

EXERCISE NO. 10
PRACTICING TERRARIUM GARDENS AND VERTICAL GARDEN

VERTICAL GARDENING:

Introduction:

The lack of vegetation in urbanized areas, as result of human establishments, directly affects the quality of life, from physical and aesthetical point of view. The construction of vertical gardens is recommended both in interiors and especially in the exterior of buildings. By applying these technologies, any kind of area can be used at its maximum capacity, obtaining esthetic valences, benefic for environment and human health. Even if the price of constructing and maintaining the vertical gardens is higher than a classical landscape it's compensated by the environmental benefits, raising the vegetation surfaces, with impact for reducing the pollution effect. The new modern concepts for landscape development are keen on using any kind of concrete or glass, turning them in real vertical gardens, being possible to overcome the development of the urban areas making a smooth transition for a healthy green urban environment.

Vertical Gardening is a special kind of urban gardening suitable to small spaces, particularly for decorating the walls and roofs in various styles. This is an alternative method for gardening by expanding the scope of growing plants in a vertical space. Intensive urbanization has left hardly any horizontal space for outdoor gardens. Green walls are not only spectacularly beautiful, but also helpful in enlivening the ambiance. Green walls can absorb heated gas in the air, lower both indoor and outdoor temperature, providing a healthier indoor air quality as well as a more beautiful space.

Types of vertical greening system:

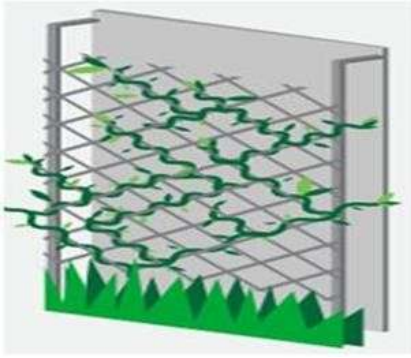
1.Green façade

2.Living/green wall

i) Modular green walls

ii)Vegetated mat wall

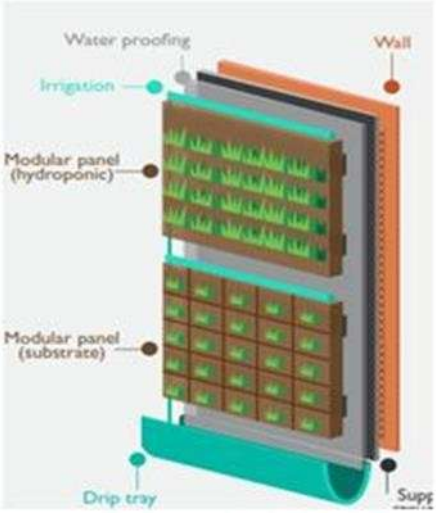
1. Green facades:



- Green facades are a type of green wall system in
- Which climbing plants or cascading groundcovers are trained to cover specially designed supporting structures.
- Plants are either grown in the ground or in the elevated containers where they are watered and fertilize green

facades are a type of green wall system in which climbing plants or cascading groundcovers are trained to cover specially designed supporing structures. Rooted at the base of these structure, in the ground, in intermediate planters or even on achieving full coverage. Green facades can be anchored to existing walls or built as freestanding structure, such as fences or columns.

2. Green walls / Living walls :

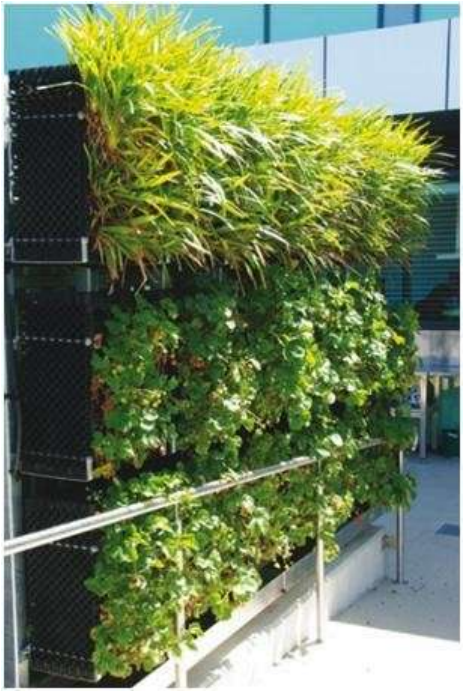


Living wall system composed of pre-vegetated panels, vertical modules or planted blankets that are fixed vertically to a structural wall or frame. These panels can be made of plastic, expanded polystyrene, synthetic fabric and support a great diversity of plants species (eg: a lush mixture of ferns, ground covers, perennials and edible plants).
Constructed from pre-vegetated panels, vertical modules or planted blankets (vegetated mat wall) that are fixed to structural framework or to a wall Made from steel framework, plastic, expanded polystyrene and synthetic fabric to support a variety of diversity and density of plant species Tend to require more maintenance such as fertilizer and water than green facade systems that are planted into the ground.

1. Modular green wall : Vertical Garden Modules is made up of recycled poly propylene material. It has attractive look, highly durable in nature and it can be easily installed. It provides instant solution for making garden in your residing place.

Green wall cups:

- Frame/ Supporting panel
- Easily detachable cups/pots



Green wall cup type/ Biowall cups

2. Vegetated mat wall:

This system, pioneered by Patrick Blanc, is composed of two layers of synthetic fabric with

pockets filled with the plants and growing media .The fabric walls are supported on a framework and backed by a waterproof membrane against the building wall Nutrients and water are delivered through an irrigation system at the top of the wall

Building and installation of Green walls:

Green wall system vary greatly in their design and construction from DIY projects to modular green wall systems. This heading provides information on

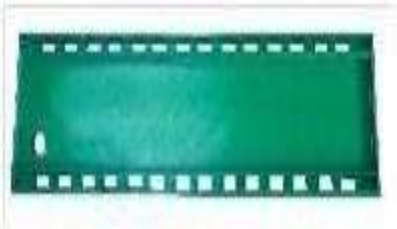
- Structures and components for green wall system
- Suitable Plants
- Growing media
- Irrigation and plant nutrition
- General considerations for green walls

Structures and components for green wall system:

Front panel

Side panel

Stabilizers



Bottom drainage tray

Completed module

Choosing the plants:

The best plants for vertical gardens are dense, compact and low growing. Make sure you choose species that suit the aspect of the wall on which they'll be growing. A wall drenched in sun, for instance, will need a selection of fairly drought-tolerant plants, whereas a shady spot – perhaps under a pergola or verandah – will require a selection of shade lovers, such as ferns. Also bear in mind that the bottom of the unit will hold more moisture than the top, so consider this when you're deciding what to plant where.

Apart from aesthetic preferences and the plants ability to grow in a soilless, vertical location; the selection of plants is based on several factors, for example: What is the local climate like (minimum temperature especially important to know)? How much sun exposure is each area of the surface receiving and how does it change during the year? Is there any particular micro climate

— such as high buildings creating strong winds along a wall? Understanding the prevailing growing conditions is essential to make the right decision when choosing plants.

Plants suitable for vertical garden :
Outdoor plants Peperomia, Syngoniums, Philodendron, Epipremnum, Begonia, Anthuriums, Nephrolepis, Chlorophytum, Lantana, Pilea, Rheo discolor, Cuphea, Fittonia, Spathiphylum, Schefflera

Indoor Green walls/ For shaded areas:

Herbaceous perennials	*Pepromia, Syngoniums, Philodendron, Epipremnum, Pepromia, Begonia, Anthuriums, Chlorophytum, Pilea, Rheo discolor, Fittonia, Spathiphylum, Schefflera*
Shrubs	*Schefflera, Ficusspp*
succulents	*Rheo discolor, Zebrinapendula, Setcreaseapurpurea*
Ferns	*Nephrolepis*

For Outdoors/Exterior Green walls:

Herbaceous perennials	*Asparagus spp., Pileamicrophylla, Alternenthera, Mentha spp.*
Succulents	*Jade plant, Sedums, Portuluca*
Shrubs	*Dusty miller, Cuphea*
Ground covers	*Baby's tear, Callisarepens*
Grass like foliage forms	*Ophiophogon, Dianellatasmanica*

Growing media:

Requirements:

1. Weightless media
2. High Water holding capacity
3. High Nutrient holding capacity
4. Good Porosity
5. Neutral pH

Cocopeat, Perlite, Sphagnum moss, vermiculite, Vermicompost, shredded bark and leaf molds are the Common media combinations used. Soil in not used since it increases the weight of the green walls.

Here are three types of growth media used in living walls:

- **Loose media**
- **Mat media**
- **Structural media.**

Loose medium

Walls tend to be "soil-on-a-shelf" or "soil-in-a-bag" type systems. Loose medium systems have

their soil packed into a shelf or bag and then are installed onto the wall. These systems require their media to be replaced at least once a year on exteriors and approximately every two years on interiors. Loose soil systems are not well suited for areas with any seismic activity. Reparations are only achieved by re-stuffing soil into the holes on the wall, which is both difficult and messy. Loose-soil systems should not be used in areas where there will be a lot of public interaction as they are quite messy and lose their soil little by little over time. Loose-soil systems with physical media erosion systems are well suited for all green wall applications.

Mat type systems tend to be either coir Fibre or felt mats. Mat media are quite thin, even in multiple layers, and as such cannot support vibrant root systems of mature plants for more than three to five years before the roots overtake the mat and water is not able to adequately wick through the mats. The method of reparation of these systems is to replace large sections of the system at a time by cutting the mat out of the wall and replacing it with new mat. This process compromises the root structures of the neighboring plants on the wall and often kills many surrounding plants in the reparation process.

Structural media are growth medium "blocks" that are not loose, nor mats, but incorporate the best features of both into a block that can be manufactured into various sizes, shapes and thicknesses. These media have the advantage that they do not break down for 10 to 15 years, can be made to have a higher or lower water holding capacity depending on the plant selection for the wall, can have their pH and EC's customized to suit the plants, and are easily handled for maintenance and replacements. They are the most robust option for a living wall for both exterior applications and for interior applications. They are also the best choice in areas where high-winds, seismic activity or heights need to be addressed in the design. Structural media are superior to the other media for their longevity and high-level of performance in a variety of circumstances. Depending on the installation, they do tend to be more expensive to install, but lower cost to maintain.

Irrigation and plant nutrition:

Green walls cannot be sustained without irrigation. Interruptions to the water supply are a common cause of plant failure on green walls. Systems designed with inbuilt irrigation should mitigate plant losses due to inconsistent moisture management, although errors can still occur. Automated, remotely controllable irrigation systems are used for walls in high profile locations, or in situations where access is challenging. Note that the quality, design and costs will vary between different systems. The most sophisticated systems enable the maintenance supervisor to keep track of the automated performance of the system, including the volume of irrigation delivered, its

frequency, substrate moisture content, as well as pH and nutrient levels in the water supply. The settings can be overridden if needed; for instance, the frequency or duration of irrigation cycles may be increased on hot days. In hydroponic systems, plant nutrition is delivered by a fertilizer injection system that releases controlled doses of fertilizer into the irrigation system (fertigation). Management of fertigation systems and rates of delivery requires specialist knowledge, as it is more complex than fertilizing soil or growing media. Hydroponic systems require continual monitoring of pH, water hardness and total dissolved solids (TDS), and adjustment of these parameters where necessary.

Design / process:

Each vertical garden is given a unique design and selection of species. The composition of plants takes in consideration the specific environment where it will be built, such as the local- and micro climate, sun exposure and the surrounding context. The aim is to create a one of a kind and site-specific garden that stands beautiful through all the seasons of the year.

A well-executed design is also a way to minimize the future maintenance demand of the garden. A plant's growth habit, size and behavior on a vertical surface is important knowledge for making the right combination of species, in order to keep the competition between plants at a healthy level. Choosing the right plant for the right place makes sense for any garden, but maybe even more so in a vertical garden..

A vertical garden can be installed in almost any location and as a living material, the potential of integrating plants in our urban environments is interesting. Places never thought of as possible could be inhabited by plants, like subway stations or other intensely frequented places where horizontal space is difficult to spare.

Light:

Direct sunlight can deliver over 100.000 lux whereas the average light level in an office is around 300-500 lux. Even if the least light demanding species are used, artificial light is normally necessary indoor. A few species will stay fine at 900 lux, but a slightly increased level at some parts of the surface will broaden the variation of species that can be used. An artificially illuminated surface has shifting light levels, due to the fact that light reduces with the square of the distance from the light source. Some areas might have 3.000 lux and others 900 lux. The plant design is made with this in mind, taking advantage of the higher levels for more demanding and interesting species.

General considerations:

- Watering: Appropriate time
- Careful selection for wind prone areas (Succulent and hardy plants)
- Removing the dried leaves
- Keeping the structure clean
- Disposing the water from drainage system
- Pruning if necessary
- Timely application of fertilizers

Benefits of Vertical gardening:

- Aesthetic effects
- Acts as natural insulation for hot and cold air and a save energy for your building
- Reduces CO2 levels and increases oxygen and improved air quality
- Conserves water and watering takes less effort
- Sound absorption and noise absorption
- Improves thermal insulation and energy efficiency
- Provides protection to buildings from adverse temperature and hence improves the life expectancy of the buildings
- Mitigate urban island heat effect
- It holds rain water, providing food and shelter for wildlife

(Do it Yourself) :

Target site

Water proofing

Fixing of frame

Mounting cups on the frame

Completed module

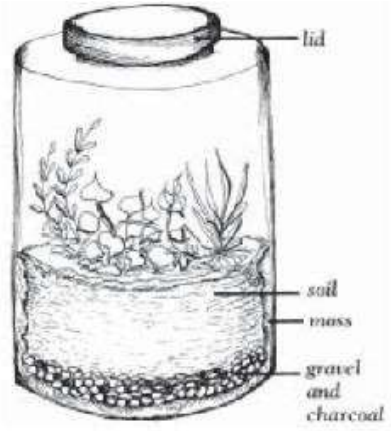
TERRARIUM

A terrarium is a collection of plants growing in a glass-enclosed container. A small garden in a glass container is easy to make and to care for Many different containers and plants can be used-whatever is available to you. In addition to plants, you can add rocks (stones), shells or pieces of bark to create miniature scenes. This indoor gardening activity can give pleasure to you and your family or friends. Also, a terrarium is a good idea for a gift.

How it works?

The glass walls allow light to reach the plants and give protection from dust, drafts, and temperature changes. The plants usually used are ones that require a high amount of moisture. Therefore, the terrarium is set up to provide a highly humid atmosphere, which means that the air contains lots of water. It works in this way, Plants give off water from their leaves in the form of gaseous water vapor. When air in the container comes in contact with the cooler glass walls, the water vapor condenses, or becomes liquid. This water runs down the sides of the container and soaks into the soil on the bottom. The water is then available for the plants to take up through their roots. The water can be used over and over again, so you will rarely need to water your terrarium. To keep the humidity high, you should always have a lid on the container to prevent the water from escaping.

You will need: Container, soil, fertilizer, Drainage Material, plants, Accessories, Tools for planting



Containers:

You will need a glass container clear enough to see through. Cloudy or tinted glass reduces the amount of light the plant receives. Any size container will do, depending on the number of plants you are using. The container should have a removable cover to control moisture. A piece of glass or plastic can be used if your container does not have a lid.

- Fish bowls
- Fish tanks or Aquarium
- Candy Jars
- Glass bowls
- Brandy Snifter
- Conical flask, glass beakers or any transparent glass container can be used

Soil:

Enough soil is needed to make a 1½-inch to 2-inch layer in the bottom of the container. The soil should be porous to allow good drainage. It should be slightly moist for planting. Equal parts of garden soil, sand, and peat moss (1:1:1).

Drainage Material:

Since terrarium has no drainage holes as that of your outdoor pots, Provision must be made for the escape of excess water. A layer of moss on the bottom of the terrarium can serve as a drainage layer in very small containers. For large containers Broken pieces of clay flower pots or charcoal, or a layer of sand or fine gravel may be added before the moss layer.

Plants:

Use small plants that grow slowly. Plant should fill the container but not crowd it. You can collect plants from your garden, local nurseries etc. This only a Suggested list and not an exhaustive one,

- Syngonium species
- Sansevieria species
- Bilbergia species
- Aechmea species
- Cryptanthus species
- *Selaginella* (Creeping Moss, Peacock Fern, Spreading Clubmoss, Resurrection Plant)
- *Hedera helix* (small-leaf varieties)
- *Pellionia* (Watermelon Pellionia, Satin Pellionia)
- *Maranta* species (Herringbone Plant, Rabbit's Tracks, Prayer Plant)

- *Peperomia* species *eperomia* species
- small ferns
- *Fitonia* species (Snakeskin Plant, Little Snakeskin Plant, Nerve Plant, Little Nerve Plant, Painted Net Leaf, Silver Net Leaf)
- Money plant (Pothos)
- Prayer plant (Maranta bi-color)
- *Pilea* (Creeping Charlie, Creeping Jenny, Aluminum Plant, Friendship Plant, Artillery Plant)
- *Helxinesoleirolii* (Mind Your Own Business Plant, Baby's Tears)

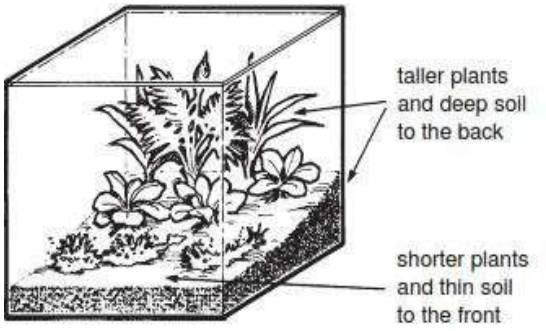
Accessories (This adds beauty and variety)

Coloured pebbles
Small toys
Shells
Barks
Stones etc

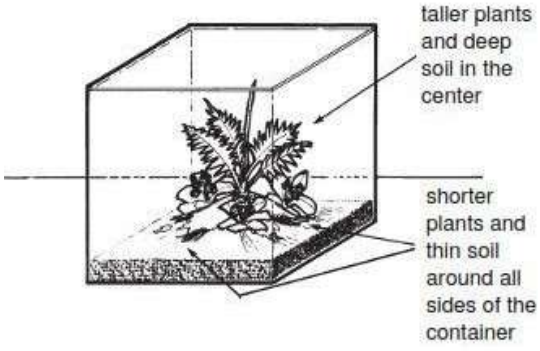
Planning:

After selecting a container, plan your terrarium layout. You can arrange plants in whatever design you wish. You may want to include small pebbles, some driftwood, or even stones to create interest, but don’t clutter your plan with too many ornaments; they will only ruin its natural look

Consider how the terrarium will be displayed. Viewed mainly from one side, plan to build toward the back of the container. Extra soil, moss, and larger plants can be placed toward the back, with smaller plants clustered toward the front.

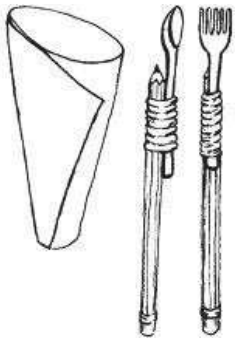


A. A terrarium viewed from one side.



B. A terrarium viewed from all sides.

Tools required: Trowel, Spoon, Tongs, Rammer, Fork cum Rake



Care and maintenance:

Once your terrarium is planted with suitable plants, the aftercare part is easy,

- Water sparingly
- Give it light- not direct sunlight, diffused or indirect light or near artificial light sources
- Pinch and prune whenever necessary

Date:-

EXERCISE NO. 11

DEVELOPMENT AND MAINTENANCE OF TOPIARY

Topiary is the art of shaping trees and shrubs by clipping and training. Topiary work means the cutting and shaping of trees into elaborate forms. These forms may be abstract or geometrical such as globe, obelisk or pyramid. They may represent birds, larger animals, living statues or just decorative objects and architectural features.

Use of topiary

Topiary work enables us to create with living plants aesthetic shapes which otherwise were only possible by means of architecture. With sophisticated techniques one can produce even sharp-edged geometrical forms, e.g. walls of any height, width or length as well as pillars, pyramids, archways and porticoes out of living plants. That is why from the landscape architect's point of view topiary is normally used where free-growing plants cannot fulfil the garden space articulating functions, but where the use of primary architectural materials like stone, timber, steel or concrete is not wanted.

Clipped Trees and Shrubs as Living Sculptures

The variety of living shapes and sculptures which can be made from yew by topiary art is limitless (Figures 3, 4 and 5). Already there exist proper sculpture gardens which show topiary work in its highest standard and variety. How to create a peacock is shown on Figure 6 as an example for topiary out of box. But we should not forget that there is the possibility of free-shaping topiary to the garden owners own ideas which plays an important role. Many topiary figures are individual fancies in individual gardens.

Clipped Trees and Shrubs for Enclosing Garden Spaces

Clipped trees and shrubs as hedging plants have an important function as an enclosure of parks and gardens. In place of free-growing plantings topiary hedging needs very little space. Moreover topiary boundary lines might be ornamented with cones, balls or figures of animals and given a greater appearance of solidity with clipped buttresses. Smaller garden compartments such as rose gardens or herbaceous borders may be enclosed by lower hedge rows.

Practice of topiary work with special interest in clipping for maintenance

Topiary work can be subdivided in three phases: clipping for training, clipping for maintenance and cutting back for regeneration.

Clipping of Young Topiary for Training

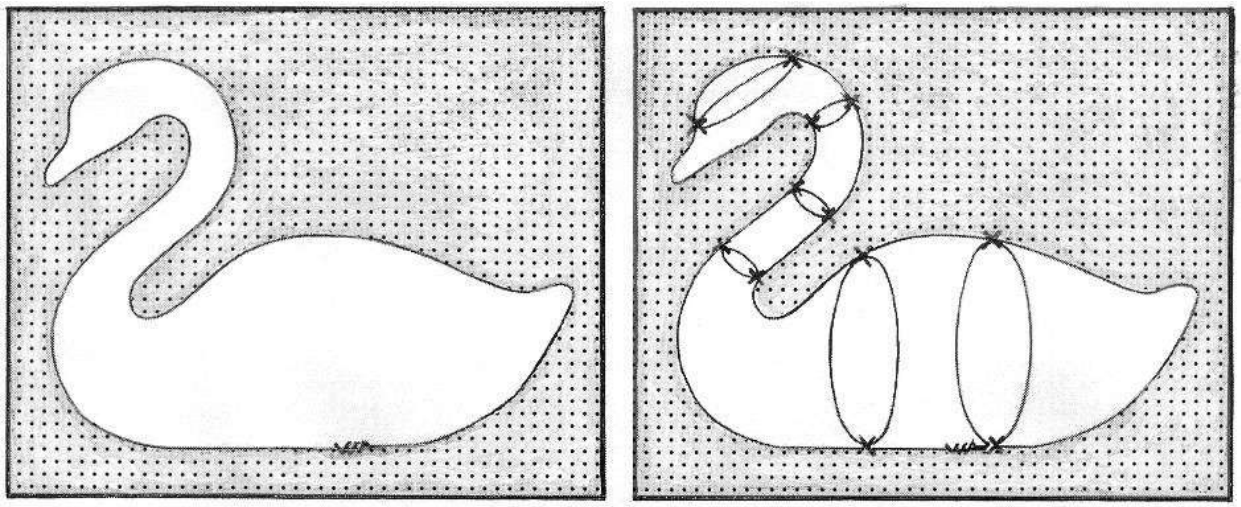
Clipping of young plants depend special requirements due to the specific kind of plant. Annually two or more clippings are normally necessary. Clipping for hedge plants treatment is shown on Figure 1 as an example.

Clipping of Mature Topiary for Maintenance

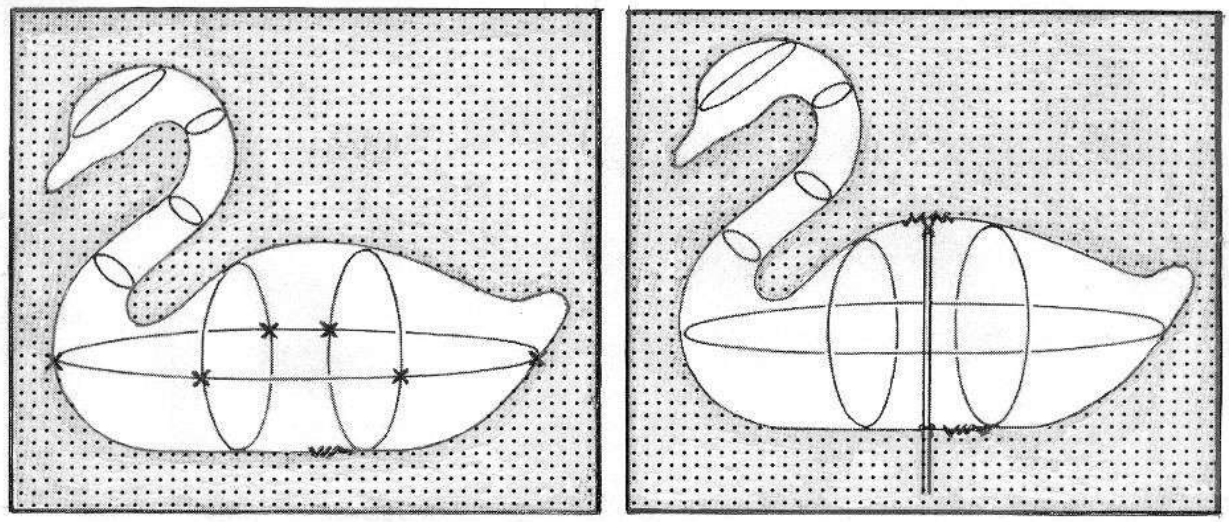
For routine maintenance of topiary normally one or two clippings per year will be sufficient. Mechanized clippers should be used for hedging plants, secateurs for specimen plants. One usually starts with the yew hedges at the end of August whilst specimen plants should be cut in September and October. The latter should have again a light treatment after getting new shootings at the end of May in the following year. Hedges should generally be clipped with a batter. That is the slope of the hedge away from the vertical. Having such an incline or batter allows the hedge to receive sun at the bottom where it should be kept dense. Box needs clipping once a year in the middle of June. In cooler regions with danger of frost clipping should be postponed since box will collapse if frost gets into the wound. And if the summer is very wet, the box will require a second clip at the end of summer.

Cutting Back of Overgrown Topiary for Regeneration

Overgrown topiary needs the following improving. For instance with yew-plants one has to cut back one side of the topiary right to the main trunk, and the tops of the plants need cutting down to the required height. Best time for this procedure is autumn. *Clerodendron inermi* will start to sprout again with sufficient growth in the following spring and summer. After three years of regeneration the other half of the topiary plant is cut in the same manner. And after another three years the whole plant will be immaculate again. Feeding of high-nitrogen fertilizer has to be maintained during the whole regeneration period.



1. A wire `silhouette` frame of a swan - a simple shape to make with one join.
2. Circles of wire are placed in position to give a three-dimensional effect. Where they touch the outline frame they are soldered or wired into position.



3. After the circles are fixed firmly into position the final bracing wire can be fixed to the opposite ends of the body. The fixing positions are shown as stars.
4. The frame is now complete - all that is needed is a strong metal rod attached to frame in two places which will enable the frame to be anchored in the ground or on top of a hedge.

Maintenance of Topiary

Shaped shrubs don't always look impressive right away. Often, they need seasons to grow into their forms. Be patient, and remember to look after your topiary:

- Water it right after you create your shape
- Continue to water it frequently, since topiaries dry out easily due to the large number of cuts, but don't flood it
- Fertilize it the same way you would any other shrub on your lawn
- Prune it twice a year: once around late May to mid-June, and again in early autumn
- If you can't wait until late spring for the first pruning, prune just before the growing season starts (for many, late March)

Garden tools for topiary making

Hedge shears, Prunning shears, Secaturs, Long handle shears, Topiary galvanized frame,

Topiary Garden in India

- Samban-Lei Sekpil, a flowering shrub use for fencing **gardens** in Manipur, is the world's tallest **topiary** at Guinness Book of Records.

- **Topiary** Park Chandigarh located in Sector-35 most popular park among the children with better playing facilities.

Plant suitable for topiary

- **Shrub**- *Clerodendron inermi, Duranta plumerii, Bougainvellia spp.*
- **Vine plant**- Hedra helix
- **Conifers**- Thuja occidetalis, Junipers, Yews
- **Herb**- Lavendula, Rosemerry, Thyme

Date:-

EXERCISE NO. 12
PRACTICING FLOWER ARRANGEMENT

FLOWER ARRANGEMENT

Flower arrangement is a tribute to nature and her profound creation – an attempt to establish a communion with nature, by capturing some of splendor and framing it in an individually conceived design. As such, it may also be considered an art, as it invokes the aesthetic faculties of the mind. But most of all, it is pastime that is rewarding and involving.

One of the greatest advantages of flower arranging is that you can produce as attractive effects with the humblest of materials, like a twisted branch picked up during your morning walk, and just a few blooms gathered from your garden as you can with a luxurious variety of flowers. Conventionally, there have been two different approaches to floral designs: **western styles**, employing a 'mass' concept of arranging flowers in an even symmetry, and **the eastern or Japanese or Ikebana styles**, which are based on specific rules and angles, using less material.

Some of the basic differences between eastern and western arrangements are

- Primarily western style is symmetrical arrangement, but eastern style is asymmetrical one.
- Western arrangements employ more flowers to create mass effect, but eastern styles impress more by the beauty of individual material.
- Contrary to western arrangements the materials in Japanese never touch the rim of the vase.
- Accessories are never used in western arrangements. But in Ikebana interesting branches, drift wood, pieces of bark, shells etc., are used to imitate the nature. Here the more emphasis is given on western arrangements.

Western styles of flower arrangement

Western style flower arrangements are associated with 'mass' or a number of flowers and foliage arranged together in a graceful manner.
In England and Europe, this style was first used to decorate palaces, mansions and churches. Traditionally, triangular, round or oval shapes were created, but after the Second World War, more designs like the L-Shape, Crescent and S-Shape were introduced. These are said to be more American in their influence.

Western designs may be scaled to large proportions and with their symmetrical patterns; they can give a touch of grandeur to a formal occasion. Small compositions look equally pretty, but whatever the size may be, it is better to go in for these styles when there is a generous availability of material. A few typical nuances of such styles can be mentioned as guidelines. These are:

- The outline of the design is normally created first with finer, lighter ‘lines’ so that the shape of the style is defined.
- There is not much emphasis on individual plant material due to the mass effect, but in the more recent western styles, ‘points’ are woven through the ‘fillers’ so that a certain planning is evident within the mass effect and the design looks more attractive. Colours are also used in the same manner. The arrangement gives a flowing, radiating effect originating as it were, from the rim of the vase, where the focus has been created with heavier points.

Getting a good start

A vase for a western arrangement requires to be fitted with a pin holder as well as a wire-netting. It also make use of an ‘ oasis’ or a block of plastic foam which is very light but becomes solid and heavy when it is immersed in water for approximately twenty minutes. The block can be conveniently cut with a knife and is fitted to fill the entire diameter of the vase. It is easy to simply push in the flowers in this sponge-like substance, but being damp, once the stems are fixed, it is advisable not to remove them as the oasis starts to crumble. As it retains water, flowers last in an oasis just as they would in a vase, but a fresh oasis has to be used each time for an arrangement.

Different models

- The triangular model
- The Round bowl model
- The Oval bowl model
- The L-Shape model
- The S-Shape model
- The Crescent shape model

1. The triangular shape Begin by first fixing the central line (A), keeping it in proportion to the vase and fixing it upright at ninety degrees. Next, insert lines (B), each about three-fourths the length of the main line, so that they lie horizontally over the rim of the vase on either side of an imaginary triangle. Insert two more lines, (C) and (D), this time short, and of unequal lengths. Place these horizontally and forward over the rim of the vase, in line with (A). These establish the width of the arrangement.

Now you can proceed with filling up the distance between (A) and (B) on either side in a symmetrically graded manner. As you make your material descend, fix it outward, the slant being more distinct with each line. Also ensure that the material is kept short, about half-way down the vase and again increases in length as you approach the rim, so that it finally merges with the

outer arms (B). Compose the rest of the arrangement with graded tiers of fillers, at the same time adding points in the manner desired, working towards the focus.

Choice of the pots: A brass vase

Choice of the plants:

Nine double tuberoses – A – central line
Six yellow gladioli – B
Eighteen pink roses – C & D
Nine money plant leaves – to fill the gap
Four variegated spider lily leaves – to balance the rose
One bunch of Thuja leaves – to cover the wire nettin

2. The round bowl model For setting the main lines of an all-round arrangement, you will need at least eight flowers for the periphery. Wedge four flowers of equal length (A) through the grill diagonally across each other. Along the same lines, insert four slightly shorter flowers (B). These long and short pairs serve to give you guidance for creating 'movement' in the arrangement. Now, take an erect flower (C) and fix it in the centre of the pin holder. This defines the height of the arrangement. If it is for a sit-down dining table, the central line should not be more than nine inches high so that is does not obstruct the vision of those sitting across the table. Fix four slightly shorter flowers (D), around (G).

From this central group, you will find it easy to proceed with the rest of the arrangement. Keep turning the vase, working on all four sides simultaneously. Begin by fixing the first pair of flowers between the gaps in the central group and grade the flowers outwards, filling in the alternate spaces to merge with the outer points of the circumference. Use heavier flowers or full blown blooms for the depth or short lengths, and buds or feathery material for the longer lengths, working within the framework of the symmetrical round. Fillers can be worked in similarly.

The longer the lengths of your peripheral lines and central line, the more flowers you will require for the arrangement. No foliage is used as the buds at the tip of the antirrhinums are contrast enough to intersperse the round forms of the roses.

Choice of the pots: A round bowl

Choice of the plants:

Two dozen double coloured orange and yellow roses – A,B &C
One-and-halfdozen antirrhinums – D & fillers

3. The oval bowl For this, an image of a rectangle must be kept in mind. The lines at the sides (A) are therefore kept long. Grouped along these main lines are (B) and (C), of different

lengths, corresponding with each other in perfect symmetry on both sides. The width is determined by two short lines, (D) which are on both sides and in front of the vase, being roughly one-fourth the length of (A). Like in the round bowl, take an erect flower for the central line (E). This must necessarily be kept low as oval bowls are usually placed on conference tables/dining tables or mantelpieces.

From the central line, on either side, grade the flowers down in the manner of fan so that the lengths of the material will slant and increase as it is arranged to merge with the outer points at the sides. Now you can proceed with filling in the vase. Remember to maintain the 'movement' with short and long stems, within the oval framework. Turn the vase around and work similarly on the other side.

Choice of the pots: Rectangular and boat shaped containers vase
Choice of the plants:
Twenty-one yellow roses – A,B,C,D,E
Two dozen sweet Williams as fillers
Two bunches of gypsophila as fillers

4. The L – shape This design is easy to make if you conform strictly to the L-Shape. If you are using a rectangular container, place the pin holder in one corner of the vase, depending on which may you would like to face your L.

Fix two main lines (A) of equal length at a right angle. While the perpendicular line will be fixed in the pin holder, the horizontal line will have to be wedged through the wire mesh so that it lies parallel to the bowl. On either side of the vertical arm, fix two shorter lengths, (B) and (C) and repeat the same for the horizontal line will have to be wedged through the wire mesh so that it lies parallel to the bowl. On either side of the vertical arm, fix two shorter lengths, (B) and (C) and repeat the same for the horizontal arm. As in the triangular style, a width is established with two short lines (D) and (E) inclining over the vase at the rim, in front of the main line.

Fill in the next tier of material between the spaces of the vertical arm, grading it down narrowly and increasing it from the vortex of the L to follow the horizontal line sideways. You can arrange the points according to your own discretion, but make sure to concentrate the focus at the vortex of the right angle.

Choice of the pots: Rectangular container
Choice of the plants:
Six white gladioli – A, D
One-and-a-half dozen larkspurs – B
Two dozen sweet sultans – C
One dozen pink roses – E

Small bunch of Gypsophila – fillers
Three aspidistra leaves – curving outwards

5. The S-shape The outline of this style must be made with curved material or with pliable branches that can be manipulated to take the form of the S. The placement of lines is in groups of three, just like in the L. Take two main curved lines (A), one facing up and the other down to form the S. Fix lines (B) and (C) on either side of (A) corresponding to each other on opposite sides. Concentrate the density of the flowers and foliage towards the rime of the vase, where the inward facing curves meet the outward curves facing down. In this way, the outline of the S will show up better.

Choice of the pots: Vase with a stem (or) a tall vase

Choice of the plants:

One dozen larkspurs – C
Five marigolds
Seven tuberoses – B
Five white sweet sultans
Three asparagus ferns
Four areca palm leaves – A

6. The crescent shape This half-moon shaped arrangement also needs curved material to form the image of the crescent in which the two arms of the arrangement look inwards at each other. Take an inward curving line (A) and fix at one side of the pin holder. Take another curving line (B), two-thirds the length of (A). As in the previous styles, fix two different curving lengths on either side of (A), corresponding them to the lines on either side of (B). Fill in the space between the crescent by arranging the material in a manner in which the flowers are shorter and heavier towards the base of the vase and lengths increase again to face inwards as they rise to go along the curve (B).

Choice of the pots: A vase with stem

Choice of the plants:

Three Royal lilies - B
Six fishbone ferns
Three Cycas (Sago) palm leaves – A
Twelve red carnations - C
Three red carnations - C

The above mentioned styles, pots and plants are just to create basic idea of western flower arrangements. By using these basic principles one can create his own styles with available pots and plants.

Eastern or Japanese or Ikebana styles

Ikebana is the Japanese art of flower arrangement, also known as *kado*, the "way of flowers". More than simply putting flowers in a container, ikebana is a disciplined art form in which nature and humanity are brought together. Contrary to the idea of floral arrangement as a collection of particolored or multicolored arrangement of blooms, ikebana often emphasizes other areas of the plant, such as its stems and leaves, and draws emphasis towards shape, line, form. Though ikebana is a creative expression, it has certain rules governing its form. The main rule is that all the elements used in construction must be organic, be they branches, leaves, grasses, or flowers. The artist's intention behind each arrangement is shown through a piece's color combinations, natural shapes, graceful lines, and the usually implied meaning of the arrangement.

Another aspect present in ikebana is its employment of minimalism. That is, an arrangement may consist of only a minimal number of blooms interspersed among stalks and leaves. The structure of a Japanese flower arrangement is based on a scalene triangle delineated by three main points, usually twigs, considered in some schools to symbolize heaven, earth, and man and in others sun, moon, love and earth. The container is also a key element of the composition, and various styles of pottery may be used in their construction.

Irrespective of the styles each flower arrangement contains the following three components.

- **Containers:** The containers or vases for flower arrangement differ in size, shape and material. it may be of porcelain, ceramic, brass, bell metals, bamboo, drift wood etc. Glass containers are not generally preferred as vases. The size of the containers varies from tall vases to flat saucers. Symmetrically or asymmetrically shaped containers are preferred depending upon the type of flower arrangement. The colour of the containers should not be bright; as such containers will detract the beauty of the blossoms. Besides the above containers, split bamboos or pieces of bamboo with two or three in internodes having holes can be also employed as natural containers especially for line arrangement. Sometimes drift wood (pieces of any lignified woody stem) with a depression on its top portion may be also used as containers for line arrangement.
- **Mechanism:** It refers to the physical mechanism by which flowers are held in oisition in containers. Pin-holders, clay balls or a crushed wire mesh are all commonly used in containers to hold the flowers in position. Deep containers

generally do not require a mechanism. However, it is a must for flat and shalloe containers. In some cases, the flowers have long and weak stalks. In such cases, the mechanism alone will not suffice to keep the flowers din position where a thin GI wire can be pushed inside the stalks to retain in position. Mechanism of flower arrangement should be such that all the stalks of the cut flowers must originate from a point. The exposed stalk of the cut flowers as far as possible must be 11/2 times the height of the containers.

- **Flowers:** The term 'flowers' in flower arrangement include real flowers, foliage, dried twigs. fruits (fresh or dry). Dry and fresh flowers may be combined or arranged separately. Colour combination adopted in a flower arrangement is highly based on individual taste and preferences.

In massing or grouping of flowers, care must be taken to have proper balance and proportion between the container and the flowers. When different flowers are combined orange coloured flowers may be combined with red flowers or blue flowers with violet coloured flowers. It is always attractive to combine all light colours or all bright colours in a vase.

Basic concepts of flower arrangement composition

1. Fresh flower and foliage.
2. Well – proportionate arrangement very rize, size of flower mat and display place have

1. to be proportionate with each other
2. Proper colour combination – colour harmony makes an arrangement pleasing colour of
3. flower mat with colour of vase and room décor should match with each other in colour.
4. Good design – Formal or informal composition with a focal point and well – balanced
5. tidy look
6. For special occasion, quality of vase, flower and other accessories have to be selected
7. with were, having though time to condition flower material and for preparing accessory
8. material before starting arrangement

5. Arrangement for all types of centre table should be low so that they do not obstruct

9. views from opposite sides and it should look attractive from all sides.

6. All artificial aids (Pinholder, oasis, wire ect) that all used too floral construction with

10. leaf moss or stones should be hidden.

7. For dining table arrangement, strong scented flowers should not be used

8. A clear simple design is far better than clumsy decoration with too many flowers choosing proper floral mot and necessary precaution any measures

Choosing of flower material:

1. Undamaged and leafy maternal
2. Single flower flowers which are not in full bloom, should be selected flower branch –
3. branches with more buds should be selected than with open flowers.
4. Leaf or grass maternal should be selected with match with flower colours and shapes.
5. Full grown leaves last longer than younger leaves.
6. Have flowers and plant materials which are proportionate to each other and match with
7. to vase size.
8. Size, colour and quality of flower material should go with the display area.

DRY FLOWER ARRANGEMENT

The art of making arrangements with dried flowers and leaves was a flourishing craft as early as the seventeenth century in England and America. But now it has passed from the hobby stage to big business in many countries. In recent years, there has developed a trend to fragrance a mixture of flowers for keeping in rooms, kitchens, toilets etc. This is known as 'Potpourri', wherein our living environment is made fragrant with natural items.

Advantages of dried arrangement over fresh flowers

- It is not dependent on season or weather if once good materials are collected.
- It lasts almost indefinitely.
- It helps the individuals to improve their skill in design by affording time to study composition and to correct mistakes.
- Dried arrangements are certainly time savers as they can be made by conveniently in advance and then enjoyed as needed.

Potpourri

Materials for dried arrangement

The materials usually employed for dried arrangement can be grouped into three categories as follows.

- Cultivated flowers and vegetable including seed, pods, vines and grains.
- Naturally available materials like flowers, seed pods, fern leaves, certain weeds and grasses.
- Pods, cones, capsules, fruits, branches, leaves, berries and flowers of broadleaved evergreen trees and shrubs.

Dried pods

Dried flowers

Preservation of plant materials There are a few methods of preserving flowers and foliage.

- **Hanging upside-down:** Many flowers dry best by this method. It is the easiest method and is preferable to those materials which keep their shape and do not fall apart while drying. Materials intended for drying are tied and allowed to hang upside down from string without touching each other.

Hanging upside-down

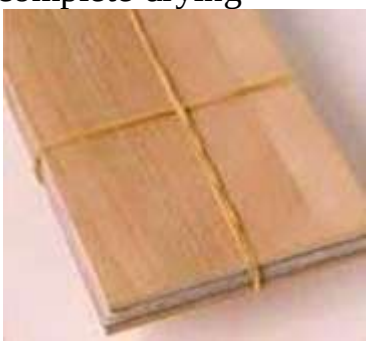
- **Burying in sand or borax:** Fine and dry sand are poured to a depth of 10 cm into a box or pan. The flowers which should be dry are stripped of all foliage and may be kept upside down on the sand and then covered with a layer of sand over them. After two weeks of time, the sand may be poured off carefully and the flowers may be taken out after gently wiping them free of sand with a soft brush. They are then ready for arrangement. Borax may be used in almost the same way as sand and is a good medium for preserving materials when space is limited. Alum and silica gel are also used in the place of borax. The form of flowers are also well preserved in borax method. Candytuft, daisies, marigold, narcissus, chrysanthemum, snapdragons, sunflowers, tithonia, all roses and coleus leaves dry well in sand or borax.

Burying in silica gel

- **Glycerin method:** This method is used for foliage only. The clean foliage materials are kept inside a jar containing a solution made up of 2/3 of water and 1/3 glycerin. The material has to be kept there till full absorption has taken place. It takes atleast two weeks for most materials to do so. Materials so preserved keep well for 5 to 10 years.

Glycerin method

- **Pressing:** Leaves and flowers can also be preserved by pressing between several thickness of newspapers and some heavy object is kept over them. It takes about three weeks for complete drying



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Pressing between papers

Design for dried arrangement The same basic principles of design apply both to dried as well as fresh arrangement. Here beauty is lacking as against in some fresh flowers, design is given much important in dried arrangement. Before deciding on a design, one has to consider the composition to be a line or mass arrangement. In line arrangement, the main emphasis is a definite outline with restrained use of interesting forms of leaves, stems, buds or seed pods. On the other hand, in mass effect in colour and form.

The pattern most frequently used are the crescent, S-curve, Triangle, fan, Round, Oval, Pyramid, L-Vertical and horizontal. The other considerations viz, balance, harmony, scale, repetition, focal point, rhythum and unity are also important in dried arrangement. The focal point or center of interest, where all important lines meet is the spot where the eyes come to rest. This is a natural place for the largest flowers, the key note of the whole composition. The focal point should be in proper scale to the rest of the composition. Hydrangeas, Celosia, Magnolia blossoms make good focal points.

Colour in dried arrangement

Flowers and foliage properly dried retain much of their colour and variety in colour may be brought out by choosing correct materials. The commonly used colour blends are monochromatic, analogous, complementary and triad. When on hue with its light and dark values or tones are brought in an arrangement, it is ‘monochromatic’. When neighbouring and closely related colours, those adjacent on the colour wheel say blue and green, yellow and orange are combined it is called ‘analogous’. On the other hand, contrasted opposite on colour wheel, as green and red are combined, it is known as ‘complementary’. Three colours equidistant on the colour wheel, as yellow, blue and red are combined it is a ‘triad’. Containers made up of dull metals like copper, brass or earthern pots and wooden vessels, old lamps and three caddies also make excellent containers.

Bases: Dried arrangements are made ‘distinctive’ by keeping them over a proper base. A commercial base of round, oval or rectangular blocks of any good wood is preferred. Bases give formality and dignity. A well-proportioned base is essential for any dried arrangement. The surfaces of the base blocks may be polished to make them shining.

The kinds of mechanism to hold the materials in fresh arrangements may also be used for dried arrangement. The dust noticed on the arrangements may be cleaned gently with a small water colour brush or wiped with a slightly moistened cloth or brush.

Triad colour blend

Date:-

EXERCISE NO. 13
BONSAI PRACTICING AND TRAINING

Bonsai is an art of growing and training of a plant to a miniature form having a natural look of old age. It was originated from china, but it was called as the Japanese art.It involves techniques of extreme dwarfing. The optimum size of bonsai may be only 30 to 60 cm in height, but miniature sizes of below 25 cm have also been preferred. Bonsai of minimum 10 years old are period, but of 100 and even 200 years of age are available and are highly valued as 'venerable' specimens. The bonsai thrives best in a sunny location and fresh air. If a bonsai is to be kept indoors it should be placed near a window where it may receive full sunshine. A bonsai is not a genetically dwarfed plant and is not kept small by cruelty in any way. In fact, given an adequate supply of water, air, light and nutrients, a properly maintained bonsai should outlive a full size tree of the same species.

Bonsai requires special types of containers. They should be usually shallow with 5 to 7.5 cm deep (except for cascade type of bonsai for which deep pots can be used). Round, hexagonal or square shaped containers with 25 to 30 cm diameters are preferred. Containers with specific colours like mosaic, sky blue, terra cotta, grey or jungle green are well suited for bonsai culture. Plants adaptable for extreme dwarfing like juniper. pine, elm, maple, cypress are suitable materials for bonsai culture. But in tropical places like India, the tree species like Manilkhara, Sapota, Bassia, Tamarind and Ficus spp. and shrubs like West Indian cherry are well suited.

Trunk and branches may be bent, forced and tied by coiling them with heavy wire. This wire is removed after several months when training to shape has been accomplished. The bonsai plants may be trained to different shapes like twisted trunk, upright, S-shaped, semi-cascade, cascade, slanting or any other formal shape. Planting of both tips and roots is usually done at planting time and periodically pinching the tip and removing the excess side shoots are essential to maintain the general outline of design. Annually, the plants are either repotted or lifted from the pot, root pruned and reset.

The bonsai plant is fed sparingly of week fertilizer solution containing major and minor nutrients. Sometimes extracts of oil cakes may be also added. Similarly, the plant is given only minimum requirements of moisture. It is advisable to water twice a day to plants kept in shallow containers and once a day to plants kept in deeper pots.

Selection of hardened woody plants that have been subjected to adverse conditions is a good starting point. Such kind of planting materials may be collected from rock crevices of from the walls of any buildings. Old seedlings kept in containers form any nursery or cutting, grafted plants or layers may be also utilized in bonsai culture.

Rules for Bonsai making

For trunk

- Height can be 6 times the caliper of the trunk.
- Should lean towards the viewer.
- It should anchor the plant.
- Roots should radiate.
- No eye poking roots.
- Should taper as it ascends
- Should not move back

For Branches

- Should not cross the trunk
- No eye poking branches
- First branch should be at one third height of the tree

- No belly branches
- Should be opposite
- Should diminish in size as it ascends
- Secondary branches are to be alternate

Principles of Bonsai

- Look for
- Small leaves or needles
- Shorter internodes
- Attractive bark or roots
- Branching characteristics
- To enhance the age, expose the one third of the roots
- Before potting, the twisted and tangled roots are to be straightened.
- Upper branches should not overshadow the lower branches.

Styles of Bonsai

Formal Upright

It is one of the most natural styles where the trunk is perfectly straight. The branches should alternate left to right to suggest age. The bottom third branches are removed and the remainder is drawn downward.

Informal Upright

This style is characterized by a lightly curving trunk displaying the harsh elements of nature. This can be achieved with ease using wire and/or cords. It is as appropriate for conifers as with deciduous trees.

Broom

It has a straight trunk that begins to divide and subdivide into many branches. The characteristics are its thick and finely branched crown. Some trees for this style are Beech, Elm, False cypress and Maple.

Slanting

It is so called because the general slope of the **trunk is highly pronounced**. The branches should lie horizontal or droop slightly downward. The surface roots have an unstable appearance but have a well anchored impression.

Windblown

It is rare in nature.
This kind of tree is found on cliffs or mountains.
The trunk, branches and twigs are trained in a single direction to give the affect of a strong wind and storm.

The Clasped-to-Stone

It is a much loved but difficult to create style. The size and shape of the rock should complement the plant that is set on a gravel or water dish. A whole chapter could be spend on this style.

<u>Cultural Practices</u>
<u>Propagation</u>

• The bonsai plants are grown from seeds, cutting, layering or grafting. It takes a longer time to propagate a bonsai from seeds than by other methods.
• A few species, like pine and Juniper are grown from seeds.
• Ficus species, pomegranate, mulberry and bougainvillea may be propagated from cuttings.
• Layering is a useful method for raising plants of Bougainvillea, *Petrea volubilis, Ixora, jasmine and pomegranate.*
• Sometimes grafting is used to propagate mango and citrus.
• The most convenient method is to start a bonsai from a small plant obtained from a nursery.
• Another method is to bring a natural dwarf and stunted plant for making a bonsai from a rocky area where it may be growing wild.

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.

Pot or Container:

• 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.

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 porus with a good drainage. Bonemeal or superphosphate in small quantity is added to the planting medium.
- If possible, sterlize the medium with steam or chemical like formaldehyde.
- Often the soil in the pot is covered with moss and one or tow small stones are placed to give a natural look.

Plant species

- Several plant species are suitable for bonsai.
- 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 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 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.
- **Repotting of old bonsai after every 2-3 years** is also helpful in proper maintenance of the bonsai.

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Date:-

EXERCISE NO. 14
CANOPY MANAGEMENT IN ORNAMENTALS SHRUBS AND PERENNIALS

Canopy in a ornamental and fruit tree refers to its physical composition comprising of stem, branches, shoots and leaves. The canopy density is determined by the number and size of the leaves, architecture of stem, branches and shoots. Canopy management of the shrub and ornamental tree deals with the development and maintenance of their structure in relation to the development of beautiful tree form suitable for garden. The basic concept in canopy management of a perennial tree is to make the best use of the land, the climatic factors for an increased beautification in a three dimensional approach.

The natural tree canopy of the shrub and tree varies greatly from species to species and cultivar to cultivar. The size, shape and volume of canopy are affected by climate, planting density, rootstock, method of propagation, training, pruning, regularity of bearing, soil type, nutrition, irrigation, intercrop, growth regulators used, diseases, pests, environmental pollution etc.,

Some of the basic principles in canopy management are as follows.

1. Maximum utilization of the light
2. Avoidance of the buildup of micro-climate congenial for the diseases and pests
3. Convenience in varying out the cultural operations and increasing the beauty of garden.

Canopy management of ornamental trees and Shrub

1. After transplanting ornamental trees or shrub in the garden field and providing the vertical support during its growing period, no shoot is allowed to grow up to 80-90 cm.
2. The height of the head is kept comparatively more than other trees to avoid the drooping branches reach and spread on the ground. Beyond this height, 4-5 side shoots which are properly placed are selected to form scaffold limbs.
3. During first 2-3 years after planting trees are trained to develop a strong framework. After that, old growth is beheaded during March, keeping 1-2 nodes above the graft union to allow vigorous new growth.
4. One upright growing vigorous shoot is retained to develop into main trunk which is kept clean of secondary branches up to 30 cm. height from the ground level.
5. On the main trunk, 3 or 4 well spaced and favourably located main branches are allowed when it is headed back. During second year, these main branches are also clipped, retaining 3-4 secondary branches on each of them. This process is continued to develop tertiary branches.

6. This basic frame of the tree is maintained by removing water sprouts as and when they emerge. Correction in the framework is done at the time of annual pruning.
7. Annual pruning in flowering and other ornamental trees is essential to induce maximum number of new healthy shoots which bear good quality fragrance flower and fruits.
8. Pruning is done during the hot and dry season when tree sheds leaves and enters into dormancy. In Maharashtra, pruning must be completed by the April end, while in Haryana by the May end. Severity in pruning also differs at different locations. In general, light pruning, at about 25 buds, is the best.

Why Pruning of Ornamental trees and shrub

Pruning is one of the most important cultural practices in landscape management. Proper pruning helps keep plants' attractive and vigorous and will add years to the plants usefulness.

- Prune to maintain plant health. Remove dead, damaged or diseased plant tissue to maintain plant health and vigor.
- Prune to increase flowering and fruiting. More flower buds will be formed for the following season if old flowers are removed when they lose their attractiveness, a practice called *dead-heading.*
- Prune to train plants to a particular size or shape, including hedge and espalier forms. Prune to rejuvenate old, overgrown shrubs and restore plant density, shape and vigor
- To improve survival chances at planting time.
- To control size and shape.
- To remove dead, diseased, weak or broken branches.
- To maintain natural beauty.

Time of pruning

The best time for pruning most plants is in the early spring while the plants are still dormant. Spring flowering shrubs may be pruned at that time, but flowers for that season will be lost. For that reason, spring flowering shrubs are usually pruned as soon as flowering has been completed.

Shrubs that flower in late spring and summer are best pruned in early spring. Avoid major pruning in late summer and early fall, as this may force late growth that will be damaged by freezing.

Date:-

EXERCISE NO. 15 & 16
VISIT TO LANDSCAPE GARDENS.