

॥ अंतरी देवू ज्ञानज्योत ॥



**NORTH MAHARASHTRA UNIVERSITY,
JALGAON.**

Syllabus for F.Y.B.Sc.

BOTANY.

(W.e.f. Acad. Yr. 2002 - 2003)

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

Syllabus To Be Implemented From Acad.Yr. 2002-2003.

Scheme of Courses

F.Y.B.Sc.

B.O.T. 1.1

PAPER - I : CRYPTOGRAMS

Ist Term : Lower Cryptograms

IInd Term : Higher Cryptograms

B.O.T. 1.2

PAPER - II : PLANT MORPHOLOGY AND PLANT ANATOMY

Ist Term : Plant Morphology

IInd Term : Plant Anatomy

B.O.T. 1.3

PAPER - III : PRACTICAL BASED ON BOT. 1.1 TO BOT 1.2

Cont..2

NORTH MAHARASHTRA UNIVERSITY, JALGAON

THEORY PAPERS TO BE STUDIED FROM

S.Y.B.Sc. TO T.Y. B.Sc. BOTANY.

Scheme of Courses

F.Y.B.Sc.

(W.e.f. Acad.Yr. 2002-2003)

B.O.T. 1.1

PAPER - I : CRYPTOGAMS

1st Term : Lower Cryptogams

2nd Term : Higher Cryptogams

B.O.T. 1.2

PAPER - II : PLANT MORPHOLOGY AND PLANT ANATOMY

1st Term : Plant Morphology

2nd Term : Plant Anatomy

S.Y.B.Sc.

(W.e.f. Acad.Yr. 2003-2004)

B.O.T. 2.1

**PAPER - I : ANGIOSPERM TAXONOMY, GYMNOSPERMS AND
PALEOBOTANY**

1st Term : Angiosperm Taxonomy

2nd Term : Gymnosperms and Paleobotany

B.O.T. 2.2

PAPER - II : PLANT PHYSIOLOGY AND APPLIED BOTANY

1st Term : Plant Physiology

2nd Term : Applied Botany

T.Y.B.Sc. (Principal)
(W.e.f. Acad.Yr. 2004-2005)

B.O.T. 3.1

PAPER - I : LOWER CRYPTOGAMS AND HIGHER CRYPTOGAMS

Ist Term : Lower Cryptogams (Algae, Fungi, Lichen, Mycoplasma)

IInd Term : Higher Cryptogams (Bryophytes and Pteridophytes)

B.O.T. 3.2

**PAPER - II : ANGIOSPERM TAXONOMY, EMBRYOLOGY,
CYTOGENETICS AND PLANT BREEDING**

Ist Term : Angiosperm Taxonomy and Embryology

IInd Term : Cytogenetics and Plant Breeding

B.O.T. 3.3

**PAPER - III : ENVIRONMENTAL BOTANY, PLANT GEOGRAPHY, PLANT
PHYSIOLOGY AND PHYTOCHEMISTRY**

Ist Term : Environmental Botany and Plant Geography

IInd Term : Plant Physiology and Phytochemistry

B.O.T. 3.4

PAPER - IV : BIOTECHNOLOGY AND HORTICULTURE

Ist Term : Biotechnology

IInd Term : Horticulture

B.O.T. 3.5

PAPER - V : COMPUTER

Ist Term : Computer-I

IInd Term : Computer-II

B.O.T. 3.6

PAPER - VI : OPTIONAL PAPERS

- (1) Gardening, (2) Pharmacognosy and Medico-botany, (3) Ethnobotany, (4) Forestry, (5) Seed Pathology, (6) Seed Technology, (7) Plant Protection, (8) Any other suggested

NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus for F.Y.B.Sc. BOTANY.
(W.e.f. Acad.Yr. 2002-2003)

THEORY PAPERS TO BE STUDIED FROM
F.Y.B.Sc. BOTANY

BOT. 1.1 : PAPER-I : CRYPTO GAMIC BOTANY
(LOWER CRYPTO GAMS & HIGHER CRYPTO GAMS)

Unit-I.

Lower Cryptogams (Viruses and Bacteria, Algae and Fungi)

	<u>[Total Periods - 45]</u>
<u>CHAPTER-I : Viruses :</u>	[4 Periods]
1.1 Introduction and General characters (Living & Non living)	[9 Marks]
1.2 Types of Viruses on the basis of shape	
1.3 Ultrastructure – Bacteriophage	
1.4 Reproduction-Lytic Cycle	
1.5 Study of viral diseases with respect to causal organism, symptoms and control measures :	
i) Yellow vein mosaic of Lady's Finger	
ii) AIDS	
<u>CHAPTER-II : Bacteria :</u>	[5 Periods]
2.1 Introduction, General characters	[11 Marks]
2.2 Classification of Bacteria on the basis of shape	
2.3 Nutrition : Autotrophic and heterotrophic	
2.4 Reproduction : Asexual, Sexual-Conjugation	
2.5 Economic importance of bacteria : Useful and Harmful	
2.6 Study of Bacterial diseases w.r.t. causal organism, symptoms and control measures :	
i) Citrus Canker	
ii) Tuberculosis	

CHAPTER-III : Algae :

- 3.1 Introduction, General characters. [5 Periods]
- 3.2 Habit and habitat [11 Marks]
- 3.3 Structure of thallus (range of variation)
- 3.4 Reproduction : Vegetative, Asexual and Sexual
- 3.5 Economic importance : Useful and Harmful

CHAPTER-IV : Classification of Algae :

- 4.1 Classification of Algae with reasons according to G.M. Smith [9 Marks]
- upto classes giving at least two examples from each class. [4 periods]

CHAPTER-V : Study of life cycle of Nostoc :

- 5.1 Classification with reasons. [4 Periods]
- 5.2 Occurrence [9 Marks]
- 5.3 Structure of Nostoc, colony and filament.
- 5.4 Ultrastructure of Nostoc cell
- 5.5 Reproduction

CHAPTER-VI : Study of Life cycle of Sargassum :

- 6.1 Classification with reasons [5 Periods]
- 6.2 Habit and habitat [11 Marks]
- 6.3 External and internal structure (Main axis and 'leaf' like structure)
- 6.4 Reproduction :
 - 6.4.1 Vegetative reproduction
 - 6.4.2 Sexual reproduction
 - 6.4.3 Structure of male and female conceptacle
 - 6.4.4 Structure of male and female sex organs.(Development not expected)

CHAPTER-VII : Fungi :

- 7.1 Introduction, General characters [5 Periods]
- 7.2 Habit and habitat [11 Marks]
- 7.3 Structure of mycelium
- 7.4 Reproduction : Vegetative, Asexual Sexual
- 7.5 Economic importance : Useful and Harmful

CHAPTER VIII : Classification of Fungi : [4 Periods]

- 8.1 Classification of fungi with reasons according to G.M. Smith [9 Marks]
upto Classes giving at least two examples from each class.

CHAPTER IX : Study of Life cycle of *Rhizopus* : [4 Periods]

- 9.1 Introduction, classification with reasons. [9 Marks]
9.2 Occurrence, structure of thallus
9.3 Reproduction : Asexual and Sexual

CHAPTER X : Study of Life Cycle of *Aspergillus* : [5 Periods]

- 10.1 Introduction, classification with reasons. [11 Marks]
10.2 Occurrence and structure of primary and secondary mycelium,
clamp connection, dikaryotization
10.3 Reproduction : Structure of basidiocarp, basidium,
basidiospores and dispersal

REFERENCE BOOKS

- Agrawal, S.B. & R.P. Srivastava (1985) Modern Text Book of Botany Vol.I Algae, Fungi, Bacteria, Viruses and Lichen, Universal Publications, Agra & Jabalpur.
- Biswas, S.B. & Amita Biswas (1986 Ed.) An Introduction to Viruses, Vikas Publishing House (P.) Ltd., New Delhi.
- Vashistha, B.R. (1991) Algae (3rd Ed.) S.Chand and Company (P.) Ltd., New Delhi
- Vashistha, B.R. (1991) Fungi (9th Ed.) S.Chand and Company (P.) Ltd., New Delhi.
- Sarabhai, B.P. & C.K Arora (1995) Text book of Algae (1st Ed.) Anmol Publications (P) Ltd., New Delhi.
- Salle, A.J. (1974) Fundamental Principles of Bacteriology (TMH Ed.), New Delhi.
- Gangulee, H.C. & A.K.Kar (1998) College Botany Vol.II New Central Book Agency (P.) Ltd. Calcutta.
- Pandey, S.N. & P.S. Trivedi (1997) A Textbook of Botany, Vol.I, Vikas Publishing House, (P.) Ltd. New Delhi.
- Sharma, P.D. (1998) The Fungi, Rastogi Publications, Meerut.
- Smith, G.M. (1955) Cryptogamic Botany Vol I (Algae & Fungi) McGraw-Hill Book Company, New York & London.

Unit-2:Higher Cryptogams (Bryophytes and Pteridophytes)[Total Periods -45]CHAPTER-XI : Bryophytes :

[4 Periods]

- 11.1 Distinguishing features of the group
- 11.2 Economic importance

[9 Marks]

CHAPTER-XII : Classification of Bryophytes :

[4 Periods]

- 12.1 Classification of Bryophytes with reasons according to S.M.Smith upto classes giving at least two examples from each class.

[9 Marks]

CHAPTER-XIII : Life Cycle of Riccia :

[7 Periods]

- 13.1 Classification with reasons
- 13.2 Habit and habitat
- 13.3 External and internal structure of gametophyte
- 13.4 Vegetative reproduction
- 13.5 Sexual reproduction and structure of sex organs
- 13.6 Fertilisation
- 13.7 Structure of mature sporophyte
- 13.8 Structure and germination of spores
- 13.9 Alternation of generations
(Development not expected)

[16 Marks]

CHAPTER-XIV : Life Cycle of Funaria :

[7 Periods]

- 14.1 Classification with reasons
- 14.2 Habit and habitat
- 14.3 External and internal structure of gametophyte
- 14.4 Vegetative reproduction
- 14.5 Sexual reproduction and structure of sex organs
- 14.6 Fertilisation, structure of mature sporophyte
- 14.7 Structure and germination of spores
- 14.8 Protonema, Alternation of generations
(Development not expected)

[16 Marks]

Cont..8

CHAPTER-XV : Pteridophytes :

- 15.1 Introduction, distinguishing features of the group
- 15.2 Economic importance

[4 Periods]

[9 Marks]

CHAPTER-XVI : Classification of Pteridophytes :

- 16.1 Classification of Pteridophytes with reasons according to G.M.Smith upto classes giving at least two examples from each class.

[4 Periods]

[9 Marks]

CHAPTER-XVII : Life Cycle of *Selaginella* :

- 17.1 Classification with reasons
- 17.2 Habit and habitat
- 17.3 External and internal structure of sporophyte
- 17.4 Vegetative reproduction
- 17.5 Asexual reproduction
- 17.6 Position and structure of strobilus and sporangium
- 17.7 Germination of spores
- 17.8 Structure of mature gametophyte
- 17.9 Position and structure of sex organs
- 17.10 Fertilisation
- 17.11 Structure of mature embryo
- 17.12 Alternation of generations
(Development not expected)

[7 Periods]

[16 Marks]

CHAPTER-XVIII : Life cycle of *Equisetum* with reference to following

points :

- 18.1 Classification with reasons
- 18.2 Habit and habitat
- 18.3 External and internal structure of sporophyte
- 18.4 Vegetative reproduction
- 18.5 Asexual reproduction
- 18.6 Position and structure of strobilus and sporangium
- 18.7 Germination of spores
- 18.8 Structure of mature gametophyte
- 18.9 Position and structure of sex organs

[8 Periods]

[16 Marks]

- 18.10 Fertilisation
18.11 Structure of mature embryo
18.12 Alternation of generation :
(Development not expected)

REFERENCE BOOKS

- Pandey, S.N. & P.S. Trivedi (1967) A Text Book of Botany, Vol. II, Vikas Publishing House (P.) Ltd. New Delhi
Parihar, N.S. (1977) Biology and Morphology of Pteridophytes, Central Book Depot, Allahabad.
Parihar, N.S. (1984) An Introduction to Embryophyta Vol. I, Eryophyta, Central Book Depot, Allahabad
Smith, G.M. (1955) Cryptogamic Botany Vol. II, (Eryophytes & Pteridophytes) McGraw Hill Company, New York & London.
Vasishta, B.R. (1997) Bryophyta, S. Chand and Company (P.) Ltd. New Delhi
Vasishta, P.C. (1984) Pteridophyta S. Chand and Company (P.) Ltd. New Delhi
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BOT 1.2 : PAPER-II : PLANT MORPHOLOGY AND ANATOMY.

Unit-I.

PLANT MORPHOLOGY

[Total Periods - 45]

CHAPTER-I : Introduction :

[3 Periods]

- 1.1 Ground plan of a plant body, functions of different organs. **[7 Marks]**
1.2 Germination : Epigeal and hypogeal germination.

CHAPTER-II : Root :

[4 Periods]

- 2.1 Definition, characteristics, functions of root, type of root. **[10 Marks]**
2.2 Modifications for storage and support :
Storage : Conical, Fusiform, Napiform, Tuber.
Support : Prop, Floating, Epiphytic, Parasitic.

CHAPTER-III : Stem :

[6 Periods]

- 3.1 Definition, characteristics, types and functions of stem. **[13 Marks]**
3.2 Types : Creepers, Climbers, Lianas, Erect
3.3 Modifications :
(a) Underground : Rhizome, Tuber, Bulbs (Tuniculated and Scaly), corm
(b) Subaerial : Runner, Sucker, Offset, Stolon
(c) Aerial : Phylloclode, Cladode, Thorn, Stem-tendrils, Bulbil.

CHAPTER-IV : Leaf :

[7 Periods]

- 4.1 Definition, parts of typical leaf, function of leaf **[16 Marks]**
4.2 Phyllotaxy : (a) alternate, (b) opposite, (c) whorled
4.3 Stipules : Free lateral, alternate, interpetiolar, intrapetiolar, orchreate, foliaceous, spiny, tendrillar.
4.4 Types of Leaf : simple and compound Leaf
4.5 Venation : Types of venation
4.6 Modifications of lamina : Leaf spines, leaf tendrils, fleshy leaf, insectivorous plant, pitcher, bladder wort.

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CHAPTER-V : Inflorescence : [6 Periods]

- 5.1 Definition [14 Marks]
5.2 Types : (a) Racemose, (b) Cymose, (c) Special types
Cyathium, Hypanthodium, Verticillaster.
5.3 Significance of inflorescence.

CHAPTER-VI : Flower : [12 Periods]

- 6.1 Definition [24 Marks]
6.2 Parts of a typical flower
6.3 Hypogyny, Epigyny, Perigyny
6.4 Calyx
6.5 Corolla : Polypetalous and gamopetalous types
6.6 Perianth
6.7 aestivation
6.8 Androecium : Cohesion and Adhesion
6.9 Gynoecium : Placentation, Types of ovules

CHAPTER-VII : Fruit : [7 Periods]

- 7.1 Definition [16 Marks]
7.2 Types
(A) Simple : (a) Dehiscent,
(b) Incohiscent : (i) Fleshy, (ii) Dry
(c) Sclizocarpic
(B) Aggregate Fruits
(C) Composite fruits : (a) Scurt, (b) Syconus

REFERENCE BOOKS

- Sudra manyam, N.S. (1997) Modern Plant Taxonomy, Vikas Publishing House P. (Ltd.)
New Delhi.
Lawrence, G.H.M. (1967) Taxonomy of Vascular Plants. (Indian Edition) Oxford & IBH
Publishers, P. (Ltd.), New Delhi, Bombay
Garqutee, H.C. & K.S.Das (1986) College Botany Vol.I (6th Ed.) New Central Book
Agency, Calcutta.

Unit-II.PLANT ANATOMY

	<u>[Total Periods - 45]</u>
<u>CHAPTER-VIII : Introduction :</u>	[2 Periods]
8.1 Definition, scope and importance	[5 Marks]
<u>CHAPTER-IX : Tissues :</u>	[8 Periods]
9.1 Definition	[18 Marks]
9.2 Meristems : classification based on position and origin.	
9.3 Permanent tissues	
a) Simple tissues , b) Complex Tissues, c) Secretory tissues	
9.4 Types of vascular bundles	
<u>CHAPTER-X : Primary structure of Dicotyledons (Sunflower) :</u>	[5 Periods]
10.1 Foot,	[11 Marks]
10.2 Stem	
10.3 Leaf	
<u>CHAPTER-XI : Primary structure of Monocotyledons (Maize) :</u>	[5 Periods]
11.1 Foot,	[11 Marks]
11.2 Stem	
11.3 Leaf	
<u>CHAPTER-XII : Comparative Anatomical Study of Dicotyledons and Monocotyledons:</u>	[3 Periods]
12.1 Foot,	[7 Marks]
12.2 Stem	
12.3 Leaf	
<u>CHAPTER-XIII : Concept of tissue systems:</u>	[15 Periods]
13.1 Epidermal tissue system	[33 Marks]
a) Definition, structure and function	
b) Cutinization, cuticularisation, lignification, suberisation, silicification	
c) Stomatal types :	
i) Ranunculaceous (Anomocytic)	
ii) Cruciferous (Anisocytic)	
iii) Caryophyllaceous (Diacytic)	
iv) Rubiaceous (Paracytic)	
v) Gramineous	
d) Epidermal outgrowths	

- 13.2 Mechanical Tissue system : Distribution of mechanical tissue in accordance with the principles stated below :
- inflexibility
 - Inextensibility
 - Incompressibility
 - Shearing stresses :
- 13.3 Secretory tissue system : (i) Glands - Digestive glands, (b) Nectaries, (c) Resin ducts, (d) Oil ducts, (e) Laticiferous ducts, (f) Hydathode.

CHAPTER-XIV : Secondary Growth :

[7 Periods]

- 14.1 Secondary growth in stem of Dicot. (Sunflower)
- 14.2 Secondary growth in root of Dicot. (Sunflower)
- 14.3 Secondary growth in stem of Monocot. (*Dracaena*)

[15 Marks]

REFERENC E BOOKS

- Chandurkar, P.L. (1971) Plant Anatomy (3rd Ed.), Oxford and IBH Publishing Co. New Delhi & Bombay.
- Gutter, E.G. (1971) Plant Anatomy : Experiment and Interpretation Part -II, Organ. Edward Arnold, London
- Drubemire, R.F. (1974) Plants and Environment, (3rd Ed.) John Wiley & Sons, New York.
- Evmes, A.J and L.H. MacDaniels (1947) An Introduction to Plant Anatomy, 2nd Ed. McGraw Hill Co. New York.
- Esau, K (1977) Anatomy of Seed Plants 2nd Ed. John Wiley, New York.
- Fahn, A (1982) Plant Anatomy 3rd Ed. Pergamon Press, Oxford & New York.
- Metcalf, C.R. and L. Chalk (1950) Anatomy of Dicotyledons Vol.I-II, Clarendon Press, Oxford.
- Pandey, B.P.(1954) Plant Anatomy. S. Chand & Company (P.) Ltd. New Delhi.
- Singh, V., Panda, P.C. & D.K.Jain (1988) Anatomy of Seed Plants, Rastogi Publications, Meerut.
- Tayal, M.S. (1954) Plant Anatomy, Rastogi Publications, Meerut.
- Vasishtha, P.C. (1986) Plant Anatomy, Prateep Publications, Jalandhar.

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PAPER III : BOT. 1.3 PRACTICAL (Based on Theory Papers I & II)

(Total -24 Practicals)

(P.S. : Permanent Slide)

Pract.(1) Study of Viruses :

Study of diseases w.r.t. name of causal organism and symptoms

- (i) Yellow vein disease mosaic of Lady's finger/Leaf curl of Tomato/Leaf mosaic of Papaya (Any Two)

Pract.(2) Study of Bacteria :

- (i) Citrus canker/Black arm of cotton.
- (ii) Gram staining in Bacteria (Root Nodules/Sugarcane juice)
- (iii) P.S. : Different forms of Bacteria

Pract.(3) Study of Nostoc :

- (i) Colony, filament and heterocyst

Pract.(4) Study of Sargassum :

- (i) External morphology
- (ii) T.S. of axis
- (iii) P.S.
 - (a) T.S. of secondary lateral (Leaf)
 - (a) T.S. of male conceptacle
 - (b) T.S. of female conceptacle

Pract.(5) Study of Rhizopus :

- (i) External morphology
- (ii) P.S. : Sexual stages (Zygosporangium)

Pract.(6) Study of Agaricus :

- (i) External morphology
- (ii) Morphology of sporocarp
- (iii) T.S. of gills
- (iv) P.S. : (a) L.S. of sporocarp,
(b) T.S. of gills

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Pract.(7) Study of leaf morphology :

- (i) Parts of a typical leaf
- (ii) Venation
- (iii) Phyllotaxy : (A) Alternate
(B) Opposite : (a) Superposed (b) Decussate
(C) Whorled

Pract.(8) Study of inflorescence :

- (i) Racemose types
- (ii) Cymose types
- (iii) Special types

Pract.(9 &10) Study of flower morphology :

- (i) Calyx : Modifications and aestivation
- (ii) Corolla : Forms of corolla and aestivation
- (iii) Androecium : Adhesion and cohesion
- (iv) Gynoecium : P.S. : Types of placentation
- (v)
- (vi)

Pract.(11&12) Study of fruit morphology :

- (i) Simple
- (ii) Aggregate
- (iii) Composite

Pract.(13) Study of Riccia :

- (i) External morphology
- (ii) Mounting and observations of rhizoids and scales
- (iii) T.S of thallus
- (iv) P.S :
 - (a) T.S.of thallus showing antheridia and archegonia
 - (b) T.S. of thallus showing sporophyte

Pract.(14) Study of Funaria :

- (i) External morphology
- (ii) Mounting and observations of rhizoids, peristome teeth and spores
- (iii) P.S. :
 - (a) T.S.of stem-axis
 - (b) V.S. of thallus showing antheridia and archegonia
 - (c) V.S. of capsule
 - (d) Protonema

Pract.(15) Study of Selaginella :

- (i) External morphology
- (ii) T.S. of stem
- (iii) Mounting of spores
- (iii) P.S. :
 - (a) T.S. of root
 - (b) T.S. of rhizophore
 - (c) V.S. of strobilus

Pract.(16) Study of Equisetum :

- (i) External morphology
- (ii) T.S. of stem (internode)
- (iii) Mounting and observations of sporangiophore, spores and elaters.
- (iv) P.S. : V.S. of strobilus

Pract.(17) Study of Tissues :

P.S. :

- (a) Meristems (L.S. of stem apex)
- (b) Xylem and phloem (T.S. & L.S.)
- (c) Types of vascular bundles

Pract.(18) Study of Sunflower : Internal structure

- (i) Primary structure of root (T.S.)
- (ii) Primary structure of stem (T.S.)
- (iii) P.S. : Leaf (T.S.)

Pract.(19) Study of Maize : Internal structure

- (i) Primary structure of root (T.S.)
- (ii) Primary structure of stem (T.S.)
- (iii) P.S. : Leaf (T.S.)

Pract.(20) Study of secondary growth.

- (i) In Dicots : Normal Secondary growth
P.S. :
 - (a) Dicot. stem
 - (b) Dicot. root
- (ii) In Monocots :
 - (c) Monocot. stem (*Dracopis*)

Pract.21) Study of stomatal types : (Feeling method)

- (i) Ranunculaceous
- (ii) Cruciferous
- (iii) Caryophyllaceous.
- (iv) Rubiaceous
- (v) Gramineous

(Any suitable locally available material may be used)

Pract.22) Study of epidermal outgrowths : (Mounting and observations)

- (i) Unicellular trichome (Cuscuta)
- (ii) Multicellular trichome
 - (a) Uniseriate (Cuscuta)
 - (b) Multiseriate (Parthenium / Tribulus)
- (iii) Glandular trichome (Boerhaavia)
- (iv) Colleters (Jatropha gossypifolia)
- (v) Peltate scales (Leaf of Ecodorea)
- (vi) Dendroid trichome (Withania somnifera)
- (vii) Stellate trichome (Crotalaria bonplandiana / Malvaceous taxa)

(Any other suitable locally available material may be used)

Pract.23) Study of mechanical tissues :

P.S.

- (i) Sunflower stem
- (ii) Sunflower root
- (iii) Maize stem
- (iv) Maize root
- (v) Leaf of Dicot. (Sunflower)
- (vi) Leaf of Monocot (Maize)

Pract.24) Local Field Tour :

To collect morphological specimens (Angiosperm morphology)

- Note :
- (i) Temporary double staining method should be followed wherever necessary
 - (ii) At least five herbarium specimens (based on Pract.24) should be submitted compulsorily at the time of practical examination.
 - (iii) Duly certified journal is compulsory at the time of practical examination.
 - (iv) Rare, endemic and endangered plants should be avoided during plant collection.
