VIDAVALUR::SPSR NELLORE DIST. A.P

(Accredited with B Grade by NAAC)

DEPARTMENT OF ZOOLOGY

Estd. 1965

TEACHING NOTES

2022-23

Dr.I.S.Chakrapani

PRR&VS GOVT. COLLEGE
VIDAVALUR
Lesson Plan -2

Name of the Department : **Zoology**

Name of the Teacher : **I.S.CHAKRAPANI**

Semester : **I**

Class : **Ist year B.Sc**

Programme / Course : **Animal diversity – Invertebrates**

Name of the Topic	Animal diversity – Invertebrates (Protozoa and Porifera & Coelenterata)
Hours Required	3 to 4 Hrs per week
Learning Objectives	To learn lower invertebrate phylum like protozoa, porifera and coelenterata. Students have to know cell, tissue & organ grade systems in these phyla. Morphological & physiological information of these Phyla to know.
Previous Knowledge to be reminded	To revise the previous knowledge at the +2 level
Thrust Areas	-
Skills to be Learnt by the student	To know the diversity among the invertebrates
Examples and Illustrations	3-4 examples per order, class will be given with showing the diagram.
Additional Inputs	Some related topics, which are out of the syllabus.
Teaching Aids used	Charts, paper clippings, slides & spotters
References Cited	Text book of Invertebrates – Kotpal Text book of Invertebrates – Jordon & Verma A.P. Academy Text book of Invertebrates
Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	-
Topic Synopsis	Synopsis Protozoa - General characters & classification. Elphidium structure & life history. Porifera - General characters & classification. Sycon structure & canal system Coelenterata - General characters & classification. Aurelia Structure, Polymorphism in coelenterates.

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Lesson Plan -3

Name of the Department : **Zoology**

Name of the Teacher : **I.S.CHAKRAPANI**

Semester : **I**

Class : **Ist year B.Sc**

Programme / Course : **Animal diversity – Invertebrates**

Name of the Topic	Animal diversity – Invertebrates (Helminthes)
Hours Required	3 to 4 Hrs per week
Learning Objectives	To learn lower invertebrate phylum like platy helminthes and nemathelminthes. Students have to know different human parasites at various levels. Morphological & physiological information of these Phylum to know.
Previous Knowledge to be reminded	To revise the previous knowledge at the +2 level
Thrust Areas	To know the nature of the round and flat worms in the body of human and the other animals.
Skills to be Learnt by the student	To know the diversity among the invertebrates
Examples and Illustrations	3-4 examples per order, class will be given with showing the diagram.
Additional Inputs	Some related topics, which are out of the syllabus.
Teaching Aids used	Charts, paper clippings, slides & spotters
References Cited	Text book of Invertebrates – Kotpal Text book of Invertebrates – Jordon & Verma A.P. Academy Text book of Invertebrates
Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT/LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	-
Topic Synopsis	General characters & classification of the Platyhelminthes and nemathelminthes with suitable examples upto the order and class. To study various parasites which occur in human and other animals.

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Lesson Plan -4

Name of the Department : **Zoology**

Name of the Teacher : **I.S.CHAKRAPANI**

Semester : **I**

Class : **Ist year B.Sc**

Programme / Course : **Animal diversity – Invertebrates**

Name of the Topic	Animal diversity – Invertebrates (Annelida)
Hours Required	3 to 4 Hrs per week
Learning Objectives	To learn lower invertebrate phylum like Annelida. Students have to know cell, tissue & organ grade systems in these phyla. Morphological & physiological information of these Phyla to know.
Previous Knowledge to be reminded	To revise the previous knowledge at the +2 level
Thrust Areas	To know the Metamerisim in the body.
Skills to be Learnt by the student	To know the diversity among the invertebrates
Examples and Illustrations	3-4 examples per order, class will be given with showing the diagram.
Additional Inputs	Some related topics, which are out of the syllabus.
Teaching Aids used	Charts, paper clippings, slides & spotters
References Cited	Text book of Invertebrates – Kotpal Text book of Invertebrates – Jordon & Verma A.P. Academy Text book of Invertebrates
Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT/LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	-
Topic Synopsis	General characters & classification of the Phylum Annelida with suitable examples upto the order and class. Earth warm as the type study. Structure and different body systems of the earth warm. Vermiculture and vermicompost and its uses and its application.

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Lesson Plan - 5

Name of the Department : **Zoology**

Name of the Teacher : **I.S.CHAKRAPANI**

Semester : **I**

Class : **Ist year B.Sc**

Programme / Course : **Animal diversity – Invertebrates**

Name of the Topic	Animal diversity – Invertebrates (Arthropoda and Mollusca)
Hours Required	3 to 4 Hrs per week
Learning Objectives	To learn lower invertebrate phylum like Arthropoda and Mollusca. Students have to know the body organization of Arthropoda and Mollusca with reference to morphological & physiological information.
Previous Knowledge to be reminded	To revise the previous knowledge at the +2 level
Thrust Areas	To know the body structure of these animals.
Skills to be Learnt by the student	To know the diversity among the invertebrates.
Examples and Illustrations	3-4 examples per order, class will be given with showing the diagram.
Additional Inputs	Some related topics, which are out of the syllabus.
Teaching Aids used	Charts, paper clippings, slides & spotters
References Cited	Text book of Invertebrates – Kotpal Text book of Invertebrates – Jordon & verma A.P. Academy Text book of Invertebrates
Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT/LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	-
Topic Synopsis	General characters & classification of the Arthropoda and Mollusca with suitable examples upto the order and class. Fresh water prawn as the type study. To know the structure and different body systems of the prawn. Structure of snail and its body organization. Peral formation in Mollusca. Torsion in Gastropoda.

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Lesson Plan - 6

Name of the Department : **Zoology**

Name of the Teacher : **I.S.CHAKRAPANI**

Semester : **I**

Class : **Ist year B.Sc**

Programme / Course : **Animal diversity – Invertebrates**

Name of the Topic	Animal diversity – Invertebrates (Echinodermata & Hemichordata)
Hours Required	3 to 4 Hrs per week
Learning Objectives	To learn lower invertebrate phylum like Echinodermata & Hemichordata. Students have to know the body organization of Echinodermata & Hemichordata with reference to morphological & physiological information.
Previous Knowledge to be reminded	To revise the previous knowledge at the +2 level
Thrust Areas	To know the body structure of these animals.
Skills to be Learnt by the student	To know the diversity among the invertebrates.
Examples and Illustrations	3-4 examples per order, class will be given with showing the diagram.
Additional Inputs	Some related topics, which are out of the syllabus.
Teaching Aids used	Charts, paper clippings, slides & spotters
References Cited	Text book of Invertebrates – Kotpal Text book of Invertebrates – Jordon & verma A.P. Academy Text book of Invertebrates
Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT/LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	-
Topic Synopsis	General characters & classification of the Echinodermata & Hemichordata with suitable examples upto the order and class. Star Fish as the type study and to know the structure and different body systems of the star fish. Structure of Balanoglossus and its affinities with the other vertebrates. To study the various Non-Chordata Larval Forms like Amphiblastrula, Ephyra, Trochophore, Nauplius, Glochidium, Bippaneria & Tomaria Larva.

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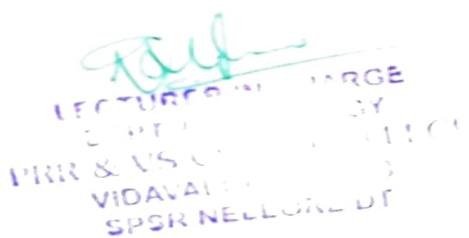
	Text book of vertebrates – Saras publications
Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT/LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	Clippings and paper news to collect
Topic Synopsis	- General Characters of Chordata and classification upto orders and classes. - Salient features of cephalo and uroChordata - Structure of branchiostoma - Structure of Herdmenia & Retrogressive metamosphosis.



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Lesson Plan - 8

Name of the Department : **Zoology**

Name of the Teacher : **I.S.CHAKRAPANI**

Semester : **II**

Class : **Ist year B.Sc**

Programme / Course : **Animal diversity –Vertebrates**

Name of the Topic	Animal diversity – Vertebrates (Cyclostomes & Fishes). Comparison of the Petromyzon & Myxine
Hours Required	3 to 4 Hrs per week
Learning Objectives	To know the general characters of Cyclostomes & two examples with suitable diagrams. General characters of fishes and the classification. Shark as the type study to know the body systems.
Previous Knowledge to be reminded	To revise the previous knowledge at the +2 level
Thrust Areas	Difference between vertebrates and invertebrates
Skills to be Learnt by the student	To know the diversity among the invertebrates
Examples and Illustrations	3-4 examples per order, class will be given with showing the diagram.
Additional Inputs	Some related topics, which are out of the syllabus.
Teaching Aids used	Charts, paper clippings, slides & spotters
References Cited	Text book of vertebrates – Kotpal

	Text book of vertebrates – Jordon & Verma A.P. Academy Text book of vertebrates Text book of vertebrates – Saras publications
Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT/LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	Clippings and paper news to collect
Topic Synopsis	- General Characters of Cyclostomes and their differences and affinities. - External characters of fishes, classification and shark as the type study. - Parental care in fishes - Migration in fishes - Scales in fishes

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Lesson Plan - 9

Name of the Department : **Zoology**

Name of the Teacher : **I.S.CHAKRAPANI**

Semester : **II**

Class : **I^st year B.Sc**

Programme / Course : **Animal diversity –Vertebrates**

Name of the Topic	Animal diversity – Vertebrates (Amphibians)
Hours Required	3 to 4 Hrs per week
Learning Objectives	To know the general characters of Amphibians with their classification and suitable examples with suitable diagrams. Common frog as the type study.
Previous Knowledge to be reminded	To revise the previous knowledge at the +2 level
Thrust Areas	Difference between vertebrates and their classes
Skills to be Learnt by the student	To know the diversity among the vertebrates
Examples and Illustrations	3-4 examples per order, class will be given with showing the diagram.
Additional Inputs	Some related topics, which are out of the syllabus.
Teaching Aids used	Charts, paper clippings, slides & spotters
References Cited	Text book of vertebrates – Kotpal Text book of vertebrates – Jordon & Verma A.P. Academy Text book of vertebrates Text book of vertebrates – Saras publications

Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT/LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	Clippings and paper news to collect
Topic Synopsis	- General Characters of Amphibians and their classification upto orders and classes with suitable examples. - Type study–common frog with all its body systems. - Parental care in Amphibia.

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Lesson Plan - 10

Name of the Department : **Zoology**

Name of the Teacher : **I.S.CHAKRAPANI**

Semester : **II**

Class : **Ist year B.Sc**

Programme / Course : **Animal diversity –Vertebrates**

Name of the Topic	Animal diversity – Vertebrates (Reptiles & Aves)
Hours Required	3 to 4 Hrs per week
Learning Objectives	To know the general characters of Reptiles & Aves with their classification and suitable examples with suitable diagrams. Colotes as the type study to know the all the body systems and its external characters. Common bird, Columbia- external characters and its body systems.
Previous Knowledge to be reminded	To revise the previous knowledge at the +2 level
Thrust Areas	Difference between vertebrates and their classes
Skills to be Learnt by the student	To know the diversity among the vertebrates
Examples and Illustrations	3-4 examples per order, class will be given with showing the diagram.
Additional Inputs	To know the various types of poisonous and non poisonous snakes. To know various flying and no flying birds.

	Feathers and wings in the birds.
Teaching Aids used	Charts, paper clippings, slides & spotters
References Cited	Text book of vertebrates – Kotpal Text book of vertebrates – Jordon & Verma A.P. Academy Text book of vertebrates Text book of vertebrates – Saras publications
Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT/LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	-
Topic Synopsis	- General Characters of Reptiles, classification and Colotes as the type study. - Different types of skulls in reptiles. - General characters of Aves, classification and the common bird Colombia as the type study. - Bird migration and flight adaptation in birds.

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Lesson Plan - 11

Name of the Department : **Zoology**

Name of the Teacher : **I.S.CHAKRAPANI**

Semester : **II**

Class : **I[st] year B.Sc**

Programme / Course : **Animal diversity –Vertebrates**

Name of the Topic	Animal diversity – Vertebrates (Mammals)
Hours Required	3 to 4 Hrs per week
Learning Objectives	To know about the highly evolved vertebrate group i.e. Mammalia and its classification upto orders which we observe every day. To know about ourselves and our body systems, our characters and the classification of different groups of Mammals
Previous Knowledge to be reminded	To revise the previous knowledge at the +2 level
Thrust Areas	Difference between vertebrates and their classes
Skills to be Learnt by the student	To know the diversity among the vertebrates
Examples and Illustrations	3-4 examples per order, class will be given with showing the diagram.
Additional Inputs	To know the various types of Mammalian groups and orders.
Teaching Aids used	Charts, paper clippings, slides & spotters
References Cited	Text book of vertebrates – Kotpal Text book of vertebrates – Jordon & Verma

	A.P. Academy Text book of vertebrates Text book of vertebrates – Saras publications
Student Activity planned after Teaching	Interaction among students and with the teacher. Students are asked the arise doubts after completion of the lesson.
Activity Planned outside the Classroom	To observe the Animal Diversity by seeing the nature. To collect related news & paper cuttings.
ICT/LMS Tools/Blogs/ Websites	Blackboard teaching and video pictures
Any other Activity	-
Topic Synopsis	- General Characters of Mammals and its classification upto classes and orders with suitable examples. - To know the 16 important classes of the Mammals - Dentition in Mammals.

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2015-16 (Year wise)

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Lesson Plan 1

Name of the Department	**Zoology**
Name of the Teacher	**I.S.Chakrapani**
Class	**FINAL YEAR**
Programme / Course	**BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture**
Name of the Topic	Capture fisheries- Introduction and blue revolution
Hours Required	2 hours
Learning Objectives	At the end of the lesson, Students will be able to – appreciate the basic information importance of blue revolution for food security in India know the different types of culture
Previous Knowledge to be reminded	Different types of Fish and Prawn Knowledge of Water bodies
Thrust Areas	Capture fisheries areas
Skills to be Learnt by the Student	
Examples and Illustrations	Catla, Rohu etc.,
Additional Inputs	Statistics of Aquaculture sector
Teaching Aids used	News clippings, videos
References Cited	A text book of Ravishankar piska
Student Activity Planned after Teaching	Asking related some questions Assignment or slip test
Activity Planned outside the Classroom	Nil
ICT/LMS Tools / Blogs/ Websites	nil
Any Other Activity	Nil

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Lesson Plan

Topic Synopsis:

- Total state wide and Indian wide capture in fishes and prawns
- In India leading states present
- Production: Marine production

  Reverine production

  Culture production

- Blue revolution;

  Introduction

  Concepts

  In present futures of aquatic culture

  Compare the Indian population to food production

  Nutritional importance

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Lesson Plan-2

Name of the Department **Name of the Teacher** **Class** **Programme / Course**	**Zoology** **I.S.Chakrapani** **FINAL YEAR** **BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture**
Name of the Topic	Fishery resources from fresh water ,brackish water and marine water
Hours Required	5 hours
Learning Objectives	Basic information Which water used in the culture of fishes and prawns Water nature and habitats Which type of fishes and prawns culture depending on the water
Previous Knowledge to be reminded	Present status in the water resource for fish culture Most of the fishes cultured in the artificial ponds Some farmers are occupied the kolleru lakein W.godavari dist. Some farmers seasonally grow paddy fields and another seasons cultivated by fishes in the paddy field.
Thrust Areas	
Skills to be Learnt by the Student	Observed in the rural ponds and tanks, flood water in the raining seasons
Examples and Illustrations	Water resource picture ex..pond ,lakes and tanks
Additional Inputs	nil
Teaching Aids used	Class room teaching
References Cited	A text book of Ravi Shankar Piska
Student Activity Planned after Teaching	Asking some related questions, slip test, assignments
Activity Planned outside the Classroom	nil
ICT/LMS Tools / Blogs/ Websites	Net visuals
Any Other Activity	-

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Lesson Plan

Topic Synopsis:

- Fresh water resourcement:

  Statically data of ponds

  Statically data of Lakes valleys

  Statically data of Cannels

  Statically data of Rivers

  Statically data of Tanks

  Statically data of Reservoirs

- Brackish water resources

  This water present confined of sea and rivers.

- Marine water resources

  In the earth 1/3parts of sea water .number of aquatic organisms' living in the sea water.

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Lesson Plan-3

Name of the Department **Name of the Teacher** **Class** **Programme / Course**	**Zoology** **I.S.Chakrapani** **FINAL YEAR** **BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture**
Name of the Topic	Cultivable fishes water fishes
Hours Required	3 hours
Learning Objectives	Basic information Some fishes are living in the fresh water Less resistance of salinity Fishes are two types-1.fin fishes 2.shell fishes
Previous Knowledge to be reminded	Some fishes survive in the ponds, tanks, lakes , reservoirs etc.. Some of them edible and some of them inedible. In India most of the cultured major carps and also exotic carps
Thrust Areas	
Skills to be Learnt by the Student	Visit to local fish market or nearby culture fish pond
Examples and Illustrations	photos
Additional Inputs	models
Teaching Aids used	Class room teaching / ppt
References Cited	Text book of fisheries - Jingaron and ravi Shankar piska
Student Activity Planned after Teaching	Assignment Student seminars
Activity Planned outside the Classroom	Visit to local fish market
ICT/LMS Tools / Blogs/ Websites	Net visuals
Any Other Activity	--

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Topic Synopsis:

Indian major carps

1. Catla catla-botcha or Krishna botcha,

   Superior feeder and fast growing, big head

2. Labe rohita-rohu or seelavathi

   Columnar feeder

3. Cirrhinus mrigala- mosu or red mosu

   Bottom feeder, body elangated

Exotic carps:

1 Cyprinus carpio- common carp

Bottom feeder, scales are arranged lines

2. Ctenopharingodon idella- grass carp

Mainly feeds on grass .most of the survive in grass areas

3. Hypopthalmycthis mlitrics-silver carps

Surface feeder, eyes are located in the below the lateral line

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Lesson Plan-4

Name of the Department **Name of the Teacher** **Class** **Programme / Course**	**Zoology** **I.S.Chakrapani** **FINAL YEAR** **BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture**
Name of the Topic	Brackish and marine water fishes
Hours Required	3 hours
Learning Objectives	Basic information Some fishes are euryheline fishes Both have different characteristics and feeding nature.
Previous Knowledge to be reminded	Brackish water present confined of sea and rivers Sea water is a completely in salt nature High cost of brackish water fishes. Some marine or fresh water fishes migrate to brackish water. Economics importance of marine fishes.
Thrust Areas	
Skills to be Learnt by the Student	Visit to local fish market or neared culture fish pond
Examples and Illustrations	photos
Additional Inputs	models
Teaching Aids used	Class room teaching / ppt
References Cited	Text book s Jingaron and ravi Shankar piska
Student Activity Planned after Teaching	Assignment Student seminars
Activity Planned outside the Classroom	Conducted field trisp and Visit to local fish market
ICT/LMS Tools / Blogs/ Websites	Net visuals
Any Other Activity	--

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Lesson Plan

Topic Synopsis:

Brackish water fishes;

1. Chanos chanos-Milk fish ,

The body bursiform shape and forked caudal fins

2. Lates calcarifer- Sea bass

Two dorsal fins one is contains spiny fin rays and second one is smooth fin rays, the edge of the caudal fin furcated

3. Musil cephalus- Mullets

Pectoral fin nearest in dorsal region, head is broad, lateral side of the scales in appeared in black lines

4. Etroplus suratensis –Pearl spot

Longitudinal shades in green color, rounded caudal fin

Marine fishes

1. Harpodon neherious-bomy duck

Try lobed caudal fins, small eyes pectoral and caudal fins are elongated

2. Rastrelliger kanagurta- Indian mekaral

Two dorsal fins and caudal region dorsal and ventral sides of the present in finlets

3. Hilsa ilisha- pulsa

It is a migrated fish from sea water to fresh water, high taste and demand in the market

4. Sardinella longiseps- oil sardains

Oils are prepared in this fish body, these oils are used soaps and paints preparations

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Lesson Plan-5

Name of the Department **Name of the Teacher** **Class** **Programme / Course**	**Zoology** **I.S.Chakrapani** **FINAL YEAR** **BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture**
Name of the Topic	Fishing craft
Hours Required	2 hours
Learning Objectives	What are the material used in the craft preparation The craft manufacturing depend on the water nature How handling the crafts Water are the types in crafts
Previous Knowledge to be reminded	Craft are used fish catching and transportation In India some peoples used old boats They are ketamerons and canos Present status in India fish catching used to mecanikal boats and steam boats. some boats are prepared in latest technology
Thrust Areas	
Skills to be Learnt by the Student	How to preparation of the boat .which motors are used in the boats,
Examples and Illustrations	boat images models
Additional Inputs	Pictures of crafts
Teaching Aids used	Class room teaching/ ppt
References Cited	Text book of Ravishankar Piska
Student Activity Planned after Teaching	Assignments and asking some related questions
Activity Planned outside the Classroom	Field trips conducted nearest harbor
ICT/LMS Tools / Blogs/ Websites	nil
Any Other Activity	Students are prepared craft models

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Lesson Plan

Topic Synopsis:

East coast sea region-water formed in the foam

West coast region- water is stagnant and low level of waves

Types of Crafts

Ketamerons:

- Korandamandal type
- Orissa type
- Adhra type-vishaka and masula type
- Crude craft
- Boat ketameron
- Dinghi
- Tuticorn
- Chip

Canos;

- Dugout canos
- Plankbult of canos
- Out trigger canos
- Built of canos

Rafts,

- Bamboo sticks platforms

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Lesson Plan-6

Name of the Department **Name of the Teacher** **class** **Programme / Course**	**Zoology** **I.S.Chakrapani** **FINAL YEAR** **BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture**
Name of the Topic	Fishing gear
Hours Required	2 hours
Learning Objectives	How to prepare the and used gear(nets) What are the types in gears How to capture in the fishes by the gear
Previous Knowledge to be reminded	In back word years the fishes are directly hunting by hands used in small pits some of them used harpoons and poisons. Presently latest nets are available; they are drag nets, korlasa and gill nets easy catching the fishes. Some peoples are fish catching in old methods at present situation
Thrust Areas	
Skills to be Learnt by the Student	Types of gears, which gears where as used in the water natures And how to catch the fishe
Examples and Illustrations	Images of gears
Additional Inputs	Models
Teaching Aids used	Class room teaching/ppt
References Cited	A text book of Ravi Shankar Piska
Student Activity Planned after Teaching	Student seminars and asking some questions subject related
Activity Planned outside the Classroom	Conducted field trip nearest harbor
ICT/LMS Tools / Blogs/ Websites	nil
Any Other Activity	---

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Topic Synopsis;

Types of gear:

Hooks

Inactivate of the fish brain

Fish screens

Fish baskets

Triangular nets

Nets:

Pursnets-karki nets and shangla nets

Drag nets- shore seines and beach siense

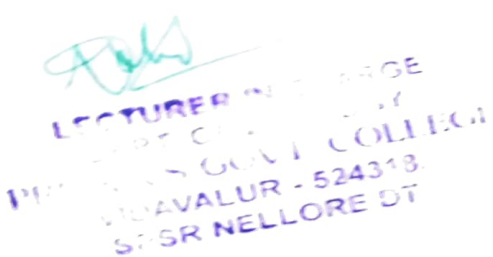
Cast nets

Kona net

Dip nets

Gill nets

Bone trappers



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Lesson Plan-7

Name of the Department **Name of the Teacher** **Class** **Programme / Course**	**Zoology** **I.S.Chakrapani** **FINAL YEAR** **BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture**
Name of the Topic	Cultivable of prawns
Hours Required	4hours
Learning Objectives	What are the prawns Whereas living Any use full for prawns
Previous Knowledge to be reminded	It is an one of the edible aquatic organism Phylum arthropod These are survive in fresh and marine water Body covered with shell also known as shell fishes
Thrust Areas	
Skills to be Learnt by the Student	Characters of prawns, uses
Examples and Illustrations	Models and specimens
Additional Inputs	Models
Teaching Aids used	Class room teaching/ppt
References Cited	A text book of Ravi Shankar Piska
Student Activity Planned after Teaching	Student seminars and asking some questions subject related
Activity Planned outside the Classroom	Conducted field trip nearest harbor
ICT/LMS Tools / Blogs/ Websites	ICT
Any Other Activity	-

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Topic **Synopsis:**

- Fresh water prawns:

  This prawns of second pair leg is very large and bulging

  Five pairs of walking legs

  2 pairs of legs in periopads

  3flagellas are present in antennules

- Macrobrachium rsenbergii
- ll Malcolm sonni
- Palaemon tenupies

Marine prawns:

This prawns of second pair leg is very large and bulging

Five pairs of walking legs

3pairs of legs in periopads

2flagellas are present in antennules

The third segment of pleura is covered second and fourth segment

- Penaeus monodon
- P-indicus
- Meta penaeus dobsoni
- Penaeus semisulcatus

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Lesson Plan-8

Name of the Department Name of the Teacher Class Programme / Course	Zoology I.S.Chakrapani FINAL YEAR BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture
Name of the Topic	Preservation fishes
Hours Required	2 hours
Learning Objectives	To know the how to preserve in fishes What are the methods in preservation Causes of preservation
Previous Knowledge to be reminded	In backward years the fishes are preserved in sea salts and also sun drying. When there is no preserved they are decomposed. Because of so many bacteria's and fungus the nature
Thrust Areas	
Skills to be Learnt by the Student	Visit local dry fish market and sea coast
Examples and Illustrations	Pictures, fish directly showing in lab
Additional Inputs	
Teaching Aids used	Class room teaching/ppt
References Cited	A text book of Ravi Shankar Piska
Student Activity Planned after Teaching	Assignment/student seminars
Activity Planned outside the Classroom	Field trip to conducted local or non local areas
ICT/LMS Tools / Blogs/ Websites	
Any Other Activity	

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Lesson Plan

Topic **Synopsis:**

Fishes are decomposed by three reasons

- Chemical reaction in the fish body
- Enzyme reactions
- Bacterial reactions

Preserve methods:

- Freezing
- Deep freezing
- Freezing and drying
- Salting
- Wet salting
- Salting and drying
- Drying-solar drying and mechanical drying
- Smoking
- Canning

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Lesson Plan-9

Name of the Department	Zoology
Name of the Teacher	I.S.Chakrapani
Class	FINAL YEAR
Programme / Course	BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture
Name of the Topic	Culture methods in fishes
Hours Required	2 hours
Learning Objectives	How to know the fish culture What are the parameters in culture Which type of fishes cultured Whereas cultivation in fishes
Previous Knowledge to be reminded	There is no in the fish cultivation in backward years Directly fish catches in natural water areas Present now most fishes are cultivated in the artificial
Thrust Areas	
Skills to be Learnt by the Student	How to cultivation ,location, selection of species,
Examples and Illustrations	Net images
Additional Inputs	Models
Teaching Aids used	Class room teaching
References Cited	A text book of Ravi Shankar Piska
Student Activity Planned after Teaching	Asking some subject related questions for student assignments
Activity Planned outside the Classroom	Field trips in local areas
ICT/LMS Tools / Blogs/ Websites	
Any Other Activity	

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Lesson Plan

Topic Synopsis:

- Types of culture methods:
- Completely fish forming
- Restricted fish forming
- Intensive fish forming
- Extensive fish forming
- Fish culture in natural water
- Mono culture
- Mono sex culture
- Sewage fed fish culture
- Non useful water fish culture
- Poly culture
- Integrated fish culture
- Cage culture

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Lesson Plan-10

Name of the Department Name of the Teacher Class Programme / Course	Zoology I.S.Chakrapani FINAL YEAR BZC-TM,BZC-EM,MZC,BIZC / Fisheries and Aquaculture
Name of the Topic	Poly culture
Hours Required	2 hours
Learning Objectives	Do know the which type of fishes cultured in poly culture What is poly culture How many species of cultured in this method what are the advantages
Previous Knowledge to be reminded	In India cultivated poly culture in backward years 3; 3:4% but low production. Present status in India the ratio of poly culture 3:3:4 or 3:5:1
Thrust Areas	
Skills to be Learnt by the Student	What are the species and ratio of poly culture method
Examples and Illustrations	Field visit
Additional Inputs	-
Teaching Aids used	Class room teaching
References Cited	A text book of Ravi shankar Piska
Student Activity Planned after Teaching	Slip test/assignment
Activity Planned outside the Classroom	Field trip
ICT/LMS Tools / Blogs/ Websites	
Any Other Activity	

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Topic Synopsis:

- Compare the mono and poly culture
- Ratio of poly culture
- Katak reagion-major carps growth
- Major carps growth-2088kg/he/year
- Exotic carp growth-2900 kg/he/year
- Both carps growth-3120 kg/he/year
- Fish and duck culture-4324 kg/he/year
- Fish and prawn culture-7000kg/he/year
- 2000 kg pig manure is used
- fish pond .it is very high nutrient and fertilizers by the water and also uses food for fishes

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DEPARTMENT OF BOTANY

2022-23

TEACHING NOTES

Paper I-

FUNDAMENTALS OF MICROBES AND NON-VASCULAR PLANTS

Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	ORIGIN OF LIFE, MILLER & UREY EXPERIMENT
Hours Required	2 HOURS
Learning Objectives	1.DIFFERENT THEOREIS ON ORIGIN OF LIFE 2. CHEMICAL EVOLUTION OF LIFE
Previous Knowledge to be reminded	WHAT IS LIFE, BIOMOLECULES
Examples/Illustrations	BACTERIA, PROTOZOA
Additional Inputs	BIOMOLECULES.
Teaching Aids Used	BLACK BOARD
References Cited	BOTANY TELUGU ACADEMI,INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY BY BHATTACHARJEE
Student Activity Planned after teaching	SEMINAR, SLIP TEST, QUIZ
Activities planned outside the class	TO OBSERVE DIVERSE MICROBES
Any other activity	NIL
Synopsis	

Concept of primary abiogenesis (Theory of chemical evolution)

Several theories were proposed to explain the origin of life on the earth. Out of which the theory of chemical evolution is widely accepted. According to this theory the life on the earth arose by a series of chemical reactions.

This theory can be explained under following steps:

1. Origin of the earth:

   A) Planetesmal hypothesis :
   B) Nebular hypothesis:

2. The primitive earth:
3. Formation of simple organic compounds:
4. Formation of complex organic compounds:
5. Formation of Protobionts or Co-acervates :
6. Formation of Eobionts:
7. Nature of primitive life and its Evolution:

Miller–Urey experiment

i) Miller-Urey created the conditions similar to be present on the early Earth and tested the chemical origin of life under those conditions.

ii) In this experiment they proved that the conditions on the primitive Earth favored chemical reactions which lead to formation of more complex organic compounds from simpler inorganic compounds.

Germplasm theory: Robert Koch.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	FIVE KINGDOM CLASSIFICATION OF R. H. WHITTAKER
Hours Required	2 HOURS
Learning Objectives	1. ILLUSTRATE DIVERSITY AMONG THE ORGANISMS
Previous Knowledge to be reminded	TWO KINGDOM CLASSIFICATION AND FIVE KINGDOM CLASSIFICATION.
Examples/Illustrations	RHIZOBIUM, AMOEABA, YEAST, PLANT AND ANIMALS
Additional Inputs	CARL WOES 3 DOMAINS
Teaching Aids Used	BLACK BOARD
References Cited	BOTANY TELUGU ACADEMI,INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY BY BHATTACHARJEE
Student Activity Planned after teaching	SEMINAR, SLIP TEST, QUIZ
Activities planned outside the class	TO OBSERVE DIVERSE MICROBES
Any other activity	NIL
Synopsis	

WHITTAKER FIVE KINGDOM CLASSIFICATION

Whitaker classified organisms into five kingdoms, based on characters like the structure of the cell, mode of nutrition, interrelationship, body organization, and reproduction. The five kingdoms are:

1.Kingdom Monera 2.Kingdom Protista 3.Kingdom Fungi 4.Kingdom Animalia 5.Kingdom Plantae

Kingdom Monera

a) These organisms are prokaryotic and unicellular.

Example: Bacteria, Cyanobacteria, and Mycoplasma.

Kingdom Protista

a) These are all unicellular, but eukaryotic organisms.

Examples: Diatoms, Protozoans like Amoeba, Paramecium.

Kingdom Fungi: Multicellular and Eukaryotic , heterotrophic organisms, cell wall - Chitin.

Examples: Yeast, Mushroom, Penicillium etc..

Kingdom Plantae

a)These are Eukaryotic, Multicellular organisms, cell wall -cellulose. autotrophs

Kingdom Animalia

a)They are Multicellular, Eukaryotic, the cell wall is absent. Heterotrophic.

MERITS: separated prokaryotes from eukaryotes

DEMERITS: not included viruses.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	Viruses
Hours Required	2 HOURS
Learning Objectives	USES OF VIRUSES AS VACCINES, VIRAL DISEASES, TRANSMISSION OF VIRAL DISEASES AND CONTROL.
Previous Knowledge to be reminded	Biodiversity
Examples/Illustrations	DISEASES AUSED BY VARIOUS MICROBES
Additional Inputs	IMPORTANCE OF BIODIVERSITY
Teaching Aids Used	BLACK BOARD, LAPTOP
References Cited	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND &COMPANY LTD.
Student Activity Planned after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
Activities planned outside the class	TO VISIT CROP FIELDS TO OBSERVE DISEASE SYMPTOMS OF VIRUS
Any other activity	NIL
Synopsis	

VIRUS IN VACCINE PRODUCTION

- Vaccine is a preparation of killed or attenuated organism or viruses.

Vaccines are made up of whole virus, or parts of them.

DIFFERENT TYPES OF VACCINES

Whole virus vaccines; Genetic material RNA (mRNA) vaccines; Viral vector vaccines;

VIRUSES AS CLONING VECTORS

A cloning vector is a small piece of DNA that can be stably maintained in an organism, and into which a foreign DNA fragment can be inserted for cloning purposes.

a)Bacteriophage cloning vector

Phage λ and M13 phage are commonly used bacteriophages in gene cloning.

b)Phagemids: **c)Cosmid:**

BIOPESTICIDES

Biopesticides can be defined as pesticides that are derived from plants, animals, microbes, or any other biologically available source

Bacillus thuringiensis (Bt)

It is widely used bacterium which can control insects such as moths, beetle, flies, aphids, butterflies etc;

Virus as Insecticides

Nuclear Polyhedrosis Viruses (NPV), Cytoplasmic Polyhedrosis Virus (CPV)

External Symptoms of Virus Infection:

(a) Primary symptoms: These symptoms appear in the form of local lesions.

(b) Systemic symptoms: In this most parts or whole of the plant is involved.

I.Chlorosis, II.Yellows: III.Necrosis): IV.Ring Spotting: V.Vein clearing:VI. Vein banding: VII. Distortion: VIII. Stunting: IX. Breaking of flowers: X. Entations:.

Transmission of Plant Viruses:

The methods are: 1. Seed Transmission of Virus 2. Transmission by Vegetative Propagation 3. Transmission by Mechanical Means 4. Transmission by Cuscuta 5. Soil Transmission 6. Insect Transmission 7. Transmission by Fungi 8. Transmission by Nematode Vectors.

CONTROL OF VIRAL TRANSMISSION:

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	BACTERIA- Archaebacteria, Actinomycetes and Cyanobacteria
Hours Required	3
Learning Objectives	Illustrate the diversity of Bacteria and their economic importance.
Previous Knowledge to be reminded	Prokaryotes and eukaryotes
Examples/Illustrations	Rhizobium, Streptomycetes,Nostocetc;
Additional Inputs	Biofertilizers, SCP
Teaching Aids Used	Black Board, Laptop
References Cited	1.Telugu Akademi - Botany -1, 2. Dubey. R.C & D.K. Maheswari (2013) A Text book of Microbiology.
Student Activity Planned after teaching	Student seminar , Gram staining
Activities planned outside the class	Field visit
Any other activity	Nil
Synopsis	

Archaebacteria:

1. Archaebacteriaare obligate or facultative anaerobes. Asexual- binary fission.

Types of Archaebacteria

The major types of Archaebacteria are discussed below:

1. Crenarchaeota:2.Euryarchaeota:3.Korarchaeota: 4.Thaumarchaeota:5. Nanoarchaeota:.

ACTINOMYCETES:

Actinomycetes are aerobic, gram +ve bacteria that form branching filamentous structure.

TYPES OF ACTINOMYCETES

IMPORTANCE OF ACTINOMYCETES:

1. Decompose organic matter and release minerals into soil.
2. Produce several antibiotics.

CYANOBACRTERIA OR BLUE GREEN ALGAE (BGA):

GENERAL CHARACTERS OF CYANOBACTERIA

STRUCTURE OF CYANOBACTERIA-prokaryotic organization.

1. Outer cellular covering. 2. Cytoplasm. 3. Nucleic material.

REPRODUCTION IN CYANOBACTERIA

Cyanobacteria also reproduce asexually and the commonest mode of reproduction in them is transverse binary fission.

In addition, there are certain specialized structures such as akinetes, hormogonia, hormocysts and spores, which are partly involved in the process of reproduction.

Heterocyst:

1. Heterocysts are special cells in cyanobacteria that can fix nitrogen.

2. The NIF genes are expressed to produce nitrogenase enzyme which convert the molecular nitrogen into ammonia.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	CELL STRUCTURE AND NUTRITION IN BACTERIA
Hours Required	3
Learning Objectives	Student will learn the structure and different parts in cell structure of Bacteria.
Previous Knowledge to be reminded	Prokaryotic cell and eukaryotic cell
Examples/Illustrations	Rhizobium, Escherichia coli etc
Additional Inputs	Root nodules
Teaching Aids Used	Balck board, laptop.
References Cited	1.Telugu Akademi - Botany -1, 2. Dubey. R.C & D.K. Maheswari (2013) A Text book of Microbiology.
Student Activity Planned after teaching	Student seminar
Activities planned outside the class	Nil
Any other activity	Nil
Synopsis	

Bacteria are prokaryotic organisms belongs to monera kingdom. The structure of bacterium is as follows.

CELL WALL: - Each bacterium is enclosed by a rigid cell wall made up of peptidoglycan a polymer of N-acetyl muramicacid (NAM) and N- acetyl glucosamine (NAG).

GLYCOCALYX: - All the structures present outside the cell wall are collectively called glycocalyx. It includes capsule, slime layer, flagella, pili etc.

Capsule: - Some species of bacteria have a rigid protective covering called capsule which is made up of polysaccharides and proteins..

Slime layer: - In some bacteria a layer outside the cell wall is present called slime later which is made up of polysaccharides.

Flagella: - Flagella are hair like structures help in locomotion for bacteria. Flagella do not show 9+2 arrangement. Based on number and arrangement of flagella the bacteria are different types like monotrichos, amphitrichous, liphotrichous ,peritrichous etc.

Pili: - Many species of bacteria have pili, short hair like projections emerging from the outside cell surface. Specialized pili called sex pili form conjugational tube between conjugating bacteria.

PLASMAMEMBRANE: -The cell membrane encloses the cytoplasm and all its components. The membrane shows inward folding called mesosomes.

CYTOPLASM: - It is a gel-like matrix composed of water, enzymes, nutrients, wastes, and gases and contains cell structures such as ribosomes, a chromosome, and plasmids.

NUCLEOID: - The chromosome, a single, circular double stranded DNA, is present in a region of the cell called the nucleoid.

PLASMIDS: - plasmid is a small, extra chromosomal, circular, self-replicative DNA .

RIBOSOMES: - 70 s type of ribosomes are present in bacteria.

NUTRITION IN BACTERIA

1. **Photoautotrophs: -**

These are following types.Green sulphurbacteria: Purple sulphur bacteria: Purple Non-sulphur bacteria:

2. **Chemoautotrophs**: They use carbon dioxide and oxidative energy as energy source.
3. **Photoheterotrophs:** They use light and organic matter as carbon source. EX: Heliobacter.
4. **Chemoheterotrophs:** They use organic matter as energy source and as carbon source.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	ASEXUAL REPRODUCTION IN BACTERIA
Hours Required	3
Learning Objectives	STUDENT WILL LEARN DIFFERENT METHODS OF REPRODUCTION
Previous Knowledge to be reminded	REPRODUCTIN IN ORGANISMS, MITOSIS, AMITOSIS
Examples/Illustrations	BACILLUS, E.COLI
Additional Inputs	CELL DIVISION
Teaching Aids Used	BALCK BOARD, LAPTOP
References Cited	1.Telugu Akademi - Botany -1, 2. Dubey. R.C & D.K. Maheswari (2013) A Text book of Microbiology.
Student Activity Planned after teaching	ASKING QUESTIONS, QUIZ, SLIP TEST
Activities planned outside the class	OBSERVATION THE SPOILAGE OF FOOD IN HOME
Any other activity	NIL
Synopsis	

Reproduction in Bacteria: 1. Binary fission 2. Endospore formation 3. Recombination

Binary fission:

1. Most common method of multiplication.
2. Occur under favorable conditions.

Endospore formation:

1. It is formed at stationary stage when nutrients are limited.
2. Spore specific substances are dipicolinic acid and calcium. The calcium-DPA complex provides heat resistance.

Recombination in bacteria:

Three methods of recombination.

1. Bacterial transformation.
2. Bacterial conjugation.
3. Bacterial transduction.

1. **Bacterial transformation**: The uptake of naked DNA by bacterial cell from external medium is known as transformation.

Binding of DNA Uptake of donor DNA Synopsis formation Integration

2. **Bacterial conjugation:**

The transfer of geneticmaterial from one bacterium to anotherby direct contact through conjugation is called conjugation. It is discovered by Lederburg and Tatum in E. coli. It is of two types 1. $F^+ \times F^-$ conjugation and 2. Hfr x F^- conjugation.

3.Bacterial transduction:

The transfer of genetic material from one bacterium to another through a virus is called transduction. It is discovered by Zender and Lederburg in Salmonella typhimurium. The defective Virus during its lytic or lysogenic cycle causes the transduction. It is two types

a) Generalized transduction- occurs during lytic cycle of virus
b) Specialized transduction- occurs during lysogenic cycle of virus.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	ECONOMIC IMPORTANCE OF BACTERIA.
Hours Required	2
Learning Objectives	STUDENT LEARNS THE USES AND DISEASES CAUSED BY BACTERIA.
Previous Knowledge to be reminded	DECOMPOSERS, MINERAL CYCLES
Examples/Illustrations	BACILLUS, RHIZOBIUM, ACTINOMYCETES
Additional Inputs	r- DNATECHNOLOGY
Teaching Aids Used	BLACK BOARD, CHARTS AND LAPTOP
References Cited	1.Telugu Akademi - Botany -1, 2. Dubey. R.C & D.K. Maheswari (2013) A Text book of Microbiology.
Student Activity Planned after teaching	QUIZ, SEMINARS, SLIP TESTS
Activities planned outside the class	FIELD VISIT TO OBSERVE BACTERIAL DISEASE IN CROPS.
Any other activity	NIL
Synopsis	

In Agriculture.

Bacteria play a vital role in agriculture for disease prevention and enhancefertility.

i. Bio-Pesticides: Bacteria acts as bio-pesticides to kill organisms causing diseases to crops andaid in higher yield.

Example: Bacillus thuringiensis is one example of pesticidesto kill pests. Some species of Bacillus and Pseudomonas act as anti-fungal agent.

ii. Bio-Fertilizers: When bacteria like Blue-green Algae are left into agriculture soil, they fixnatural manure in form of nitrogen from air for better growth and yield of crops.Further, the organic waste acts as natural manure and gives essential nutrientsto the crops.

iii. Crop Rotation: Crop rotation if done with leguminous crop soil fertility will be increased.

In Medicine.

i. Production of Antibiotics: A number of anti-bacterial and anti-fungal antibiotics such as hamycin,polymyxin, trichomycin etc. are obtained from Streptomyces. Similarly, Bacillus is used for production of antibiotics such asbacitracin, gramicidin etc.

ii. Production of Vitamins: Different kinds of vitamins produced like vitamin B12 vitamin K and B-complex from Escherichia coli.

iii. Genetic Engineering: insulin, vitamin B12 etc

iv. Production of Vaccines: Bacteria are used to produce vaccines by either separating their antigens.

In Industry:

i. Fibre Retting: Clostrodiumbutyricumused to separate fibers of jute,hemp and flax.

ii. Curing of Tobacco and Tea: Bacteria are useful in the curing or ripening of tobacco leaves.

iii. Dairy Industry: Bacteria such as Lactobacillus convert milk sugar lactose

v. Biotechnology: It is the use of microorganisms including bacteria in the manufacturing and services industries.

vi. Sterilization: **vii. Tanning:**

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	ECONOMIC IMPORTANCE OF BACTERIA.
Hours Required	2
Learning Objectives	STUDENT LEARNS THE USES AND DISEASES CAUSED BY BACTERIA.
Previous Knowledge to be reminded	DECOMPOSERS, MINERAL CYCLES
Examples/Illustrations	BACILLUS, RHIZOBIUM, ACTINOMYCETES
Additional Inputs	r- DNATECHNOLOGY
Teaching Aids Used	BLACK BOARD, CHARTS AND LAPTOP
References Cited	1.Telugu Akademi - Botany -1, 2. Dubey. R.C & D.K. Maheswari (2013) A Text book of Microbiology.
Student Activity Planned after teaching	QUIZ, SEMINARS, SLIP TESTS
Activities planned outside the class	FIELD VISIT TO OBSERVE BACTERIAL DISEASE IN CROPS.
Any other activity	NIL
Synopsis	

In Agriculture.

Bacteria play a vital role in agriculture for disease prevention and enhancefertility.

i. Bio-Pesticides: Bacteria acts as bio-pesticides to kill organisms causing diseases to crops andaid in higher yield.

Example: Bacillus thuringiensis is one example of pesticidesto kill pests. Some species of Bacillus and Pseudomonas act as anti-fungal agent.

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iii. Crop Rotation: Crop rotation if done with leguminous crop soil fertility will be increased.

In Medicine.

i. Production of Antibiotics: A number of anti-bacterial and anti-fungal antibiotics such as hamycin,polymyxin, trichomycin etc. are obtained from Streptomyces. Similarly, Bacillus is used for production of antibiotics such asbacitracin, gramicidin etc.

ii. Production of Vitamins: Different kinds of vitamins produced like vitamin B12 vitamin K and B-complex from Escherichia coli.

iii. Genetic Engineering: insulin, vitamin B12 etc

iv. Production of Vaccines: Bacteria are used to produce vaccines by either separating their antigens.

In Industry:

i. Fibre Retting: Clostrodiumbutyricumused to separate fibers of jute,hemp and flax.

ii. Curing of Tobacco and Tea: Bacteria are useful in the curing or ripening of tobacco leaves.

iii. Dairy Industry: Bacteria such as Lactobacillus convert milk sugar lactose

v. Biotechnology: It is the use of microorganisms including bacteria in the manufacturing and services industries.

vi. Sterilization: **vii. Tanning:**

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	Symptoms of plant diseases caused by Bacteria and Citrus canker.
Hours Required	01
Learning Objectives	Students come to know Symptoms of plant diseases caused by Bacteria and Citrus canker.
Previous Knowledge to be reminded	Germ theory of disease
Examples/Illustrations	Various diseases
Additional Inputs	nil
Teaching Aids Used	Black board, Laptop
References Cited	1.Telugu Akademi - Botany -1, 2. Dubey. R.C.& D.K. Maheswari (2013) A Text book of Microbiology.
Student Activity Planned after teaching	Go to rice fields to observe blast disease of rice.
Activities planned outside the class	Students asked to recognize citrus canker.
Any other activity	nil

Synopsis

Bacterial diseases can be grouped into four broad categories based on the extent of damage to plant tissue and the symptoms that they cause, which may include 1.vascular wilt, 2. Necrosis, 3. Softrot, and 4. Tumors.

1. Vascular wilt results from the bacterial invasion of the plant's vascular system.
2. Pathogens can cause necrosis by secreting a toxin (poison). Symptoms include formation of leaf spots, stem blights, or cankers.
3. Soft rot diseases are caused by pathogens that secrete enzymes capable of decomposing cell wall structures, thereby destroying the texture of plant tissue.
4. Tumour diseases are caused by bacteria that stimulate uncontrolled multiplication of plant cells, resulting in the formation of abnormally large structures.

Transmission and infection: Bacterial pathogens enter plants through wounds, humans, tools and machinery, insects, and nematodes, or through natural openings such as stomata, lenticels, hydathodes, nectar-producing glands, and leaf scars.

Control:

i. Seed treatment with hot water at about 50 °C (120 °F).
ii. Bactericidal seed compounds control some bacterial diseases.
iii. Rotation with non-host crops reduces loss.
iv. Eradication and exclusion of host plants.
v. Resistant varieties of crop plants.
vi. Protective insecticidal sprays help control bacterial diseases.

Citrus canker: caused by the bacterium Xanthomonascitri

Symptoms

The disease causes small, round blister-like formations on leaves, branches, stems, new shoots and fruit.

Control: Today, with regards to treating citrus canker via chemicals, worldwide the disease is managed with preventive copper-based bactericides.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	FUNGI- GENERAL CHARACTERS & CLASSIFICATION
Hours Required	2
Learning Objectives	Illustrate the diversity of fungi, Classify fungi Analyze and ascertain the plant diseases by fungi Evaluate the ecological and economic value of fungi
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	Mushrooms, yeast, fermentation etc
Additional Inputs	Mushroom culture,
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany -1, 3. Fungi- Text first degree students by B.R. Vashista& A.K. Sinha
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Field trip
Any other activity	Slip test
Synopsis	

Characteristics of Fungi

Following are the important characteristics of fungi:

Fungi are eukaryotic, non-vascular, non-motile and heterotrophic organisms.

- They may be unicellular or filamentous.
- Filamentous forms may be septate or aseptate and coenocytic.
- Septa may be simple pore septa or dolipore septa.
- They reproduce by means of spores.
- Fungi lack chlorophyll and hence cannot perform photosynthesis.
- Fungi store their food in the form of glycogen and oils.
- Cell wall made up of chitin.

Mode of nutrition

Saprophytic – The fungi obtain their nutrition by feeding on dead organic substances. Examples: Rhizopus, Penicillium and Aspergillus.

Parasitic – The fungi obtain their nutrition by living on other living organisms (plants or animals) and absorb nutrients from their host. Examples: Taphrina and Puccinia.

Symbiotic – Lichens and mycorrhiza.

Classification of Fungi:

Kingdom Fungi are classified into the following based on the formation of spores:

Mastigomycotina – Algal fungi, oospore is formed

Zygomycotina –Asepatate, coenocytic mycelium. Zygospore Ex: Rhizopus

Ascomycotina – They are also called as sac fungi. The sexual spores are called ascospores. Saccharomyces

Basidiomycotina – Mushrooms are the most commonly found basidiomycetes and mostly live as parasites. Sexual reproduction occurs by basidiospores. Asexual reproduction occurs by conidia, budding or fragmentation. Example- Agaricus

Deuteromycotina – They are otherwise called imperfect fungi. Example – Trichoderma.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	FUNGI- RHIZOPUS
Hours Required	3
Learning Objectives	Illustrate the diversity of fungi, Classify fungi Analyze and ascertain the plant diseases by fungi Evaluate the ecological and economic value of fungi
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	MUCOR, Rhizopusstolanifer
Additional Inputs	heterothallism
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany -1, 3. Fungi- Text first degree students by B.R. Vashista&A.K. Sinha
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Field trip
Any other activity	Slip test
Synopsis	

1. Common fungi growing on stale bread, therefore, also called Bread mould.
2. Lives as a saprophytes

Structure of thallus:

1. The fungus consists of white cottony, much branched mycelium.
2. The mycelium has three types of hyphae 1. Stolans 2. Rhizoids 3. Sporangiosphore.
3. Cell wall is chitinous.
4. The mycelium is aseptate and coenocytic.

Reproduction in Rhizopus:

Rhizopus reproduces by vegetative, asexual and sexual mode.

1. Vegetative reproduction: It takes by fragmentation.
2. Asexual reproduction: By means of

(a) sporangiospore and (b) chlamydospores

(a) sporangiospores formation:

During favourable condition, the non-motile spores such as sporangiospores or aplanspores are formed inside the sporangium.

(b) Chlamydospore:.

During unfavourable condition mycelium produce chlamydospores.

2. Sexual reproduction:

Most of the species of Rhizopus are heterothallic (Rhizopus. stolonifer), but few species (R. sexualis) are homothallic.

3. In heterothallic species, zygospores are produced by the union of two gametangia developed from mycelia of compatible strains

5. The heterothallic species are cultured, two mycelia of compatible strain come near to each other, the mycelia produce small outgrowth, called progametangia.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	FUNGI- PUCCINIA LIFE CYCLE.
Hours Required	3
Learning Objectives	Illustrate the diversity of fungi Classify fungi Analyze and ascertain the plant diseases by fungi Evaluate the ecological and economic value of fungi
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	Mushrooms, yeast, fermentation etc
Additional Inputs	Annual reoccurrence of Puccinia
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany -1, 3. Fungi- Text first degree students by B.R. Vashista& A.K. Sinha
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Field trip
Any other activity	Slip test
Synopsis	

PUCCINIA macrocyclic fungi.

The wheat is primary host and barberry is secondary host or alternate host.

In its life cycle it shows two types of mycelia. 1. Monokaryotic primary mycelium 2. Dikaryotic secondary mycelium.

It completes its life cycle in 5 stages

1. Stage 0 - Pycnidial stage – produced on barbeery
2. Stage 1 – aecial stage – produced on barbeery
3. Stage 2 - Uredineal stage - produced on wheat
4. Stage 3 - Telial stage - produced on wheat
5. Stage 4 – Basidial stage - produced in the soil on germination of teliospores

Life cycle of puccinia on wheat :

(a) **Uredineal Stage:**

Early in growing season aeciospores germinate on wheat to produce secondary mycelium on wheat. uredia produce uredospores .

(b) Telial Stage: The teleutospores are, at first, developed among the uredosporesin the same sorus. They are of dark brown or black colour. Gradually as the season progresses more and more teleutospores are produced whereas the number of uredospores is reduced. Finally the sori contain only the teleutospores.

(c) **Basidial Stage :** After the resting period and under favourable conditions the teleutospores germinates in situ to produce the basidial stage in the life cycle. . Karyogamy and meiosis takes place in teliospores to give rise haploid, uninucleatedbasidiospores.

(d) **Life cycle on barberry:** Pycnidial stage and aecial stage produced on barbeery

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	FUNGI- Symptoms of plant diseases caused by fungi
Hours Required	2
Learning Objectives	Illustrate the diversity of fungi,Classify fungi Analyze and ascertain the plant diseases by fungi Evaluate the ecological and economic value of fungi
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	Mushrooms, yeast, fermentation etc
Additional Inputs	Mushroom culture,
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany -1, 3. Fungi- Text first degree students by B.R. Vashista& A.K. Sinha
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Field trip
Any other activity	Slip test
Synopsis	

Leaf Spots: Leaf spots are usually rather definite spots of varying sizes, shapes and colors. There is nearly always a distinctive margin.

Leaf Blights: Leaf blights are generally larger diseased areas than leaf spots and more irregularly shaped. Sometimes the "blighting" appearance of leaves is the result of the coalescence of numerous small spots.

Rusts: Rusts often produce spots similar to leaf spots, but the spots are called "pustules." Rust pustules are bright yellow, orange-red, reddish-brown or black in color. Rusts are common on grains and grasses.

Powdery Mildew: Powdery mildew is a superficial, white to light grayish, powdery to mealy growth on leaves, but may also occur on stems and flowers. Affected leaves usually turn yellow, wither and die rapidly. The problem is common on cucurbit-type vegetables and on small grains.

Downy Mildew: Downy mildew symptoms are pale yellow green to yellow areas on the upper leaf surface; light gray to purplish moldy growth on the under surface of the leaf. Blue mold of tobacco is a downy mildew disease.

Necrocis, Chlorosis, Smuts, Stunting are other fungal diseases.

RICE BLAST DISEASE

This disease caused by Pyriculariaoryzae, a fungus. The rice blast pathogen develops in the nodes, leaves, collars, necks, panicles, seedsand roots over the entire growth period.

Control:

Use of fungicides, Crop rotation, Use of resistant rice varieties.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	FUNGI- LLICHENS
Hours Required	2
Learning Objectives	Illustrate the diversity of lichens., Classify Lichens Evaluate the ecological and economic value of lichens.
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	Mushrooms, yeast, fermentation etc
Additional Inputs	Mushroom culture,
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany -1, 3. structure and function of Algae- Fritch
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Field trip
Any other activity	Slip test

Synopsis

Lichens are a small group of plants of composite nature, consisting of two dissimilar organisms, an alga-phycobiont and a fungus-mycobiontliving in a symbiotic association.

Characteristics of Lichens:

Based on the morphological structure of thalli, they are of three types crustose, folioseand fruticose.

(a)Vegetative reproduction: soredia and isidia.

(b) Asexual reproduction: By the formation of oidia.

(c) Sexual reproduction: By the formation of ascospores or basidiospores. Only fungal component is involved in sexual reproduction.

Anatomy of lichens

1. Homoisomerous: Here the fungal hyphae and the algal cells are more or less uniformly distributed.
2. Heteromerous: Here the thallus is differentiated into four distinct layers upper cortex, algal zone, medulla,and lower cortex.

C. Specialised Structures of Thallus:1. Breathing Pore: 2. Cyphellae: 3. Cephalodium: are endotrophic.

Economic importance of Lichen:

1. As Food and Fodder:

Lichens are used as food by human being in many parts of the world and also by differentanimals like snail, catterpiliars, slugs, termites etc. They contain polysaccharide, lichenin;cellulose, vitamin and certain enzymes.

2. As Medicine:

Lichens are medicinally important due to the presence of lichenin and some bitter orastringent substances. They have been used in the treatment of jaundice, diarrhoea, fevers and epilepsy, hydrophobia and skin diseases.

3. Industrial Uses:

Lichens of various types are used in different kinds of industries.

(i) Tanning Industry: **(ii) Brewery and Distillation**: **(iii) Preparation of Dye:(iv) Cosmetics and Perfumery :**

Harmful Activities of Lichens:

Lichens like Lethariavulpina (wolf moss) are highly poisonous.

Pioneer of Rock Vegetation. Lichens are used as "pollution indicators".

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	ALGAE – GENERAL CHARACTERS, THALLUS ORGANIZATION.
Hours Required	2 HOURS
Learning Objectives	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
Previous Knowledge to be reminded	Whittaker five kingdom classification
Examples/Illustrations	Spirogyra , Polysiphonia etc.,
Additional Inputs	SCP
Teaching Aids Used	BLACK BOARD, LAPTOP, CHART
References Cited	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND &COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
Student Activity Planned after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
Activities planned outside the class	FIELD VISIT
Any other activity	NIL
Synopsis	

GENERAL CHARACTERSTICS OF ALGAE

Pant body: known as Thallus and they are non-vascular

Habitat: Algae are usually aquatic, either freshwater or marine and some are terresterial.

Algae are eukaryotic thallophytes photoautotrophs. Storage form of food: Starch

Reproduction: Vevetative method:

Asexual spore: zoospores, aplanospores, hypnospores, akinetes, azygospore

Sexual method: isogamous, anisogamous, and oogamousgametic fusion

Thallus organization:

The algal thallus organization can be classified in these following groups such as

Unicellular- Chlamydomonas, chlorella unicellular with spiral filament. Example: Spirulina

2. Multicellular Form

Colonial Aggregation: Coenohium, Palmelloid: Dendroid: **Rhizopodial**:

B. Filamentous Forms

(i). Un-branched Filament with or without apical basal polarity.

Example: free-floating -Spirogyra, attached – Oedogonium etc.

(ii). Branched Filament-(a). Falsely branched: Example: Scytonema

(b). Truly branched : simple, heterotrichous.

i. Simple Filament- ii. Heterotrichous Habit:iii. Parenchymatous forms:

iv. Pseudoparenchymatous Habit: The Pseudoparenchymatous is formed when one or more central or axial filaments get together with their branch fuses and develop a parenchymatous structure. Example:Batrachospermum, Polysiphonia.

C. Siphonous Organization

In Botrydium ,Vaucheria enlarged and elaborate thallus without septa is seen.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	ALGAE – CLASSIFICATION.
Hours Required	1HOURS
Learning Objectives	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
Previous Knowledge to be reminded	Whittaker five kingdom classification
Examples/Illustrations	Spirogyra , Polysiphonia etc.,
Additional Inputs	SCP
Teaching Aids Used	BLACK BOARD, LAPTOP, CHART
References Cited	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND &COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
Student Activity Planned after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
Activities planned outside the class	NIL
Any other activity	NIL
Synopsis	

The primary classification of algae is based on certain morphological and physiological features . These are...

- Pigment composition
- Chemical nature of reserve food
- Kind, no., point of insertion and relative length of flagella
- Presence or absence of a definite nucleus

Most authentic and comprehensive classification was proposed by F. E. Fritsch (1935) who published his voluminous work in the form of a book entitled "Structure and Reproduction ofAlgae" in two volumes. He classified algae into 11 classes. These are---

1. Chlorophyceae (green algae)
2. Xanthophyceae (Yellow-green algae)
3. Chrysophyceae4. Bacillariophyceae (Diatoms)
5. Cryptophyceae
6. Dinophyceae (Dinoflagellates)
7. Chloromonadineae
8. Euglenophyceae
9. Phaeophyceae (Brown algae)
10. Rhodophyceae (Red algae)
11. Myxophyceae (blue green algae)

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	ALGAE – SPIROGYRA LIFE CYCLE
Hours Required	3 HOURS
Learning Objectives	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
Previous Knowledge to be reminded	Whittaker five kingdom classification
Examples/Illustrations	Spirogyra adnataetc,
Additional Inputs	Conjugation in Bacteria.
Teaching Aids Used	BLACK BOARD, LAPTOP, CHART
References Cited	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND &COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
Student Activity Planned after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR, QUIZ.
Activities planned outside the class	Field visit
Any other activity	NIL
Synopsis	

Occurrence: Spirogyra is a cosmopolitan, freshwater, filamentous green alga.

Morphology: The plant body of Spirogyra is an un-branched filamentous, Uniseriate. Each cell of Spirogyra filament is cylindrical and consists of 2 parts: cell wall and protoplast. The cell wall made up of cellulose and pectin. Central large vacuole and thin layer of cytoplasm is present. Nucleus suspended in vacuole by cytoplasmic strands.

The primordial utricle contains 1-16 spirally arranged ribbon-shaped chloroplasts.Chloroplast possessespyrenoids.

A. Vegetative cycle: by fragmentation.
B. Asexual cycles: Asexual cycles involve the formation of aplanospores, akinetes and parthenospores..
C. Sexual cycle: Sexual reproduction of Spirogyra involves conjugation.
(i) Scalariform conjugation: It is most common method in most heterothallic species.
(ii) Lateral conjugation: It involves the fusion of gametes from two adjacent cells of the same filament .
(a) Indirect lateral conjugation:
(b) Direct lateral conjugation: In this type of conjugation, the male gametangium after passing through an aperture in the transverse
Germination of Zygospore: Zygospore is the only diploid phase in the sexual life cycle. It divides by meiosis and form haploid spores.
Life cycle of Spirogyra is haplontic life cycle.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	ALGAE – Polysiphonia
Hours Required	4 HOURS
Learning Objectives	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
Previous Knowledge to be reminded	Whittaker five kingdom classification
Examples/Illustrations	Polysiphonia
Additional Inputs	SCP, USE OF MARINE ALGAE.
Teaching Aids Used	BLACK BOARD, LAPTOP, CHART
References Cited	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND &COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
Student Activity Planned after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
Activities planned outside the class	NIL
Any other activity	NIL
Synopsis	

Polysiphonia:

Polysiphonia is a red algae, polysiphonous and usually well branched, with some plants reaching a length of about 30 cm. They are attached by rhizoids or hapterato a rocky surface or other alga. The thallus consists of fine branched filaments each with a central axial filament supporting pericentral cells.The number of these pericentral cells (4–24) is used in identification.

Reproduction and life cycle :

It has three stages.1.Gametophyte 2.Carposporophyte and 3.Tetrasporophyte.

The male gametophytes produce spermatia in spermatangia and the female gametophytes produce egg in the carpogonium.

Spermatia come along with water currents and come to carpogonium fertilize with egg. This phenomenon is called spermatization.

Post fertilization changes: After fertilization the diploid zygote develops to become the carposporophyte, that produce carpospores in the carposporangium which give the tetra sporophyte again which give tetraspores which grow to become the male and female plants.

The life in Polysiphonia is called diplobiontic life cycle

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	ALGAE – ECONOMIC IMPORTANCE.
Hours Required	1 HOUR
Learning Objectives	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
Previous Knowledge to be reminded	Whittaker five kingdom classification
Examples/Illustrations	Spirogyra , Polysiphonia etc.,
Additional Inputs	SCP
Teaching Aids Used	BLACK BOARD, LAPTOP, CHART
References Cited	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND &COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
Student Activity Planned after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
Activities planned outside the class	COLLECTION OF AGAR
Any other activity	NIL
Synopsis	

Economic Importance of Algae

1. Algae as Food:

Algae have been in use as human food for centuries in various parts of theWorld. Their nutritional value is quite high, as they contain a good amount of proteins, carbohydrates, fats and vitamins, specially A, B, C and E.

2. Algae as Fodder: Laminaria saccharine, Ascophyllum sp., Sargassum sp. and Fucus sp.,

3.Algae in Pisciculture: Algae, both floating and attached forms, marine as well as fresh water, provide the primary food for fish and other aquatic animals.

4.Algae as Fertilizer:The members of the class Cyanophyceae

5. Reclamation of alkaline 'usar' land :

6. Binding of soil particles : Algae act as an important binding agent on the surface of the soil.

7. Algae used in space research : Chlorella, Spirulina are being used in space research.

8. Commercial products: Phaeophyceae and Rhodophyceae, produce chiefly agar-agar, alginic acid and carrageenin.

Algin and Alginates:

Algin is a calcium magnesium salt of alginic acid present in Phaeophyceae.

iv. Diatomite :

Fossil forms of diatoms in some regions are found in large deposits which are called 'Diatomaceous earth'. It is mainly used in insulation, as a filtering agent and as an abrasive, in the industrial filtration processes.

Harmful effects:

Cephaleurous causes rust on coffee.

Algal blooms retard the growth of fishes in water body by causing suffocation.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	General characters of Bryophytes and classification.
Hours Required	2
Learning Objectives	1. Illustrate the diversity of Bryophytes 2. Classify Bryophytes 3. Evaluate the ecological and economic value of Bryophytes 4. Understand the evolution of sporophyte in Bryophytes
Previous Knowledge to be reminded	Moss plants, amphibians of plant kingdom.
Examples/Illustrations	Marchatia, Anthoceros, polytrichum, Funaria.
Additional Inputs	Microscopic slides showing.
Teaching Aids Used	Charts, Black board, laptop, projector.
References Cited	1. Botany-1: Telugu Akademi, Hyderabad. 2. Pandey, B.P. - College Botany, Volume-I, S. chand publishing.
Student Activity Planned after teaching	Interaction, Quiz, Student seminars & Slip test.
Activities planned outside the class	Nil
Any other activity	Nil
Synopsis	

General characteristics of Bryophyta

1.The plant body is a gametophyte. They grow in areas which are in between the aquatic and terrestrial habitats i.e. amphibious zone and hence known as amphibious plants.

2. They have thalloid or leafy multicellular green plant body.

3. The plant body lacks true roots, stem or leaves.

4. The plants are green and possess chloroplasts.

5. They show autotrophic mode of nutrition.

6. Vascular tissues are completely absent.

7. Sexual reproduction is oogamous.

8. Male reproductive organ is antheridium. It produces biflagellate male antherozoids.

9. The female sex organ is archegonium. It has egg cell in its venter.

10. Water is essential for fertilization.

Classification: 3 classes

1. Hepaticopsida- liverworts
2. Anthocerotopsida- hornworts
3. Bryopsida- mosses

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	Marchantia – morphology and anatomy
Hours Required	2 HOURS
Learning Objectives	Illustrate the diversity of Bryophytes Classify Bryophytes Evaluate the ecological and economic value of Bryophytes Understand the evolution of sporophyte in Bryophytes
Previous Knowledge to be reminded	Moss plants, amphibians of plant kingdom.
Examples/Illustrations	Marchatia, Anthoceros, polytrichum, Funaria.
Additional Inputs	Evolutionary importance of marchantia.
Teaching Aids Used	Charts, Black board, laptop, projector.
References Cited	1. Botany-1: Telugu Akademi, Hyderabad. 2. Pandey,B.P.- College Botany, Volume-I, S. chand publishing.
Student Activity Planned after teaching	Interaction, Quiz, Student seminars & Slip test.
Activities planned outside the class	Nil
Any other activity	NIL
Synopsis	

All species are terrestrial and cosmopolitan in distribution. The species prefer to grow in moist and shady places. M. polymorpha is common in India

Morphology: The plant body is gametophytic, thalloid, flat, and prostrate.

Dorsal surface: Dorsal surface is dark green. It has a midrib and a number of polygonal areas called areolae. The midrib is marked on the dorsal surface by a shallow groove with gemma cups.

Sexual reproductive structures are borne on special Stalked structures called gametophores

Ventral surface: The ventral surface of the thallus bears scales and rhizoids along the midrib.

Anatomy of the Gametophyte:

A vertical cross section of the thallus can be differentiated 1. photosynthetic zone and 2. Lower storage zone.

1. photosynthetic zone:

The outermost layer is upper epidermis. Its cells contain few chloroplasts. Its continuity is broken by the presence of many air pores. Each pore is surrounded by four to eight superimposed tiers of concentric rings. Many simple or branched photosynthetic filaments arise from the base of the air chambers.

2.Storage zone: It lies below the air chambers. It consists of several lasers of compactly arranged, thin walled parenchymatous isodiametric cells. Intercellular spaces are absent.The cells of this zone contain starch. Some cells contain a single large oil body or filled with mucilage. The lower most cell layer of the zone forms the lower epidermis. Some cells of the middle layer of lower epidermis extend to form both scales and rhizoids.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	Marchantia – Reproduction.
Hours Required	2 HOURS
Learning Objectives	Illustrate the diversity of Bryophytes Classify Bryophytes Evaluate the ecological and economic value of Bryophytes Understand the evolution of sporophyte in Bryophytes
Previous Knowledge to be reminded	Moss plants, amphibians of plant kingdom.
Examples/Illustrations	Marchatia, Anthoceros, polytrichum, Funaria.
Additional Inputs	Evolutionary importance of marchantia.
Teaching Aids Used	Charts, Black board, laptop, projector.
References Cited	Botany-1: Telugu Akademi, Hyderabad. Pandey,B.P.- College Botany, Volume-I, S. chand publishing.
Student Activity Planned after teaching	Interaction, Quiz, Student seminars & Slip test.
Activities planned outside the class	
Any other activity	NIL
Synopsis	

Marchantia Reproduction:

Asexual Reproduction: by fragmentation or by forming specialised structures known as gemmae.

Gemmae: They reproduce asexually by gemmae, which are asexual buds. They are formed in the receptacles known as gemma cups.Gemmae detach and germinate to give rise new filament.

Sexual Reproduction: Marchantia is dioecious. Male and female sex organs develop on different thalli. Male antheridia and the female archegonia. They are born on the antheridiophore and archegoniophore, respectively. Antherozoids are produced in the antheridium are biflagellated. The archegonium is a flask-shaped structure. It cosist of neck canal cells, a ventral canal cell and an egg.

Fertilization:

They need water for fertilization like other bryophytes. The neck canal cells and the ventral canal cell disintegrate and form a mucilaginous mass, which oozes out as the archegonia swells after absorbing water. It consists of chemical substances, which triggers the chemotactic response. The antherozoids get attracted and swim towards archegonia. One of the antherozoids fuses with egg and fertilization takes place. The male and female nuclei fuse together to form a diploid cell called the zygote.

Sporophyte:

The diploid zygote does not undergo meiosis (reduction division) immediately. It rather divides mitotically and develops into a multicellular structure called the sporophyte. The sporophyte is differentiated into foot, seta and capsule. It is dependent on the gametophyte for nourishment. Some of the cells of sporogenous tissue called spore mother cells (diploid) divide meiotically to produce haploid spores. These haploid spores are released by the dehiscence of the capsule. Under favourable conditions, they germinate to form the new haploid plant or gametophyte.

Marchantia Life Cycle:

Marchantia show alternation of generation, i.e. the haploid sexual and diploid asexual phase alternates. The life cycle of Marchantia is haplodiplontic.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	Funaria – morphology and anatomy
Hours Required	2 HOURS
Learning Objectives	Illustrate the diversity of Bryophytes, Classify Bryophytes Evaluate the ecological and economic value of Bryophytes Understand the evolution of sporophyte in Bryophytes
Previous Knowledge to be reminded	Moss plants, amphibians of plant kingdom.
Examples/Illustrations	Marchatia, Anthoceros, polytrichum, Funaria.
Additional Inputs	Evolutionary importance of Funaria
Teaching Aids Used	Charts, Black board, laptop, projector.
References Cited	Botany-1: Telugu Akademi, Hyderabad. Pandey,B.P.- College Botany, Volume-I, S. chand publishing.
Student Activity Planned after teaching	Interaction, Quiz, Student seminars & Slip test.
Activities planned outside the class	Slip test
Any other activity	NIL
Synopsis	

Gametophytic Phase of Funaria:

(A) External Features: Plant body is gametophytic and consists of two different stages namely:(i) Juvenile stage-primary protonema and(ii) The leafy gametophore which represents the adult form. The adult gametophyte (gametophore) is differentiated into rhizoids, axis or 'stem' and 'leaves'. Rhizoids are multicellular with oblique septa, stem is branched and leaves arranged spirally. No vascular tissues are present.

(B) Internal Structure:stem transverse section show (i) Epidermis (ii) Cortex (iii) Central cylinder.

(i)Epidermis: It is the outer most single layered. Cuticle and stomata are absent.

(ii) Cortex:It is made up to chlorenchymatous cells.

(iii) Central Conducting Strand: It is made up of long, narrow thin walled dead cells which lack protoplasm. These cells are now commonly called as hydroids.

2. Leaf: Except the midrib region, the 'leaf' is composed of single layer of parenchymatous polygonal cells.

Reproduction in Funaria: Funaria reproduces by vegetative and sexual methods.

(i) Vegetative Reproduction: It takes place by the following methods:

1. By multiplication of primary protonema: 2. By secondary protonema: 3. By Gemmae

4. By Bulbils: 5. Apospory:

Development of gametophyte from sporophyte without the formation of spores is known as apospory.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	Funaria– Reproduction.
Hours Required	2 HOURS
Learning Objectives	Illustrate the diversity of Bryophytes Understand the evolution of sporophyte in Bryophytes
Previous Knowledge to be reminded	Moss plants, amphibians of plant kingdom.
Examples/Illustrations	Marchatia, Anthoceros, polytrichum, Funaria.
Additional Inputs	Evolutionary importance of marchantia.
Teaching Aids Used	Charts, Black board, laptop, projector.
References Cited	Botany-1: Telugu Akademi, Hyderabad. Pandey,B.P.- College Botany, Volume-I, S. chand publishing.
Student Activity Planned after teaching	Interaction, Quiz, Student seminars & Slip test.
Activities planned outside the class	Nil
Any other activity	NIL
Synopsis	

Sexual reproduction:

Sexual reproduction is oogamous. Male reproductive structure is known as antheridium and female as archegonium and both are stalked.

Antheridia: developed on anteridial branch. Antheridia are club shaped. Intermingled with paraphyses. Antherozoids are biflagellatd.

Archegonia: They are flask shaped, developed on archegoniophore. Archegoniophore bear archegonia, paraphyses and protected by perichaeial leaves.

Archegonium has stalk, venter and neck. Venter has egg and VCC , neck has NCC.

Fertilization in Funaria: Water is essential for fertilization.zooidogamous oogamy.

Sporophytic Phase: Zygote is the first cell of the sporophytic phase.The sporophyte is semi-parasitic in nature, the mature sporophyte can be differentiated into three distinct parts—foot, seta and capsule. Capsule has apophasis- photosynthetic zone, theca - fertile part and operculum.Capsule has spore sac and sprore mother cells. Spore mother cells undergo meiosis to form haploid spores. Operculum has peristomial teeth which help in release of spores.

Germination of spore – protonema

Protonema further gives rise to secondary protonema, gemmae and adult gametophore.

Life cycle of Funaria

Funaria shows alternation of haploid gametophyte and diploid sporophyte. The life cycle is said to be haplodiplontic life cycle.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	FUNDAMAENTALS OF MICROBES AND NON-VASCULAR PLANTS
Name of the Topic	Evolution of sporophyte in Bryophytes.
Hours Required	2 HOURS
Learning Objectives	Illustrate the diversity of Bryophytes Classify Bryophytes Evaluate the ecological and economic value of Bryophytes Understand the evolution of sporophyte in Bryophytes
Previous Knowledge to be reminded	Moss plants, amphibians of plant kingdom.
Examples/Illustrations	Marchatia, Anthoceros, polytrichum, Funaria.
Additional Inputs	Evolutionary importance of marchantia.
Teaching Aids Used	Charts, Black board, laptop, projector.
References Cited	1. Botany-1: Telugu Akademi, Hyderabad. 2. Pandey,B.P.- College Botany, Volume-I, S. chand publishing.
Student Activity Planned after teaching	Interaction, Quiz, Student seminars & Slip test.
Activities planned outside the class	
Any other activity	NIL
Synopsis	

Evolution of Sporophyte in Bryophytes:

There are two opposing theories regarding the evolution of sporophyte

(i) Theory of Progressive evolution or theory of sterilisation".

This theory was advocated by Bower and supported by Cavers and Campbell. According to this theory, the primitive sporophyte is simple (Riccia) evolved into complex sporophyte (moss) by progressive sterilization."

First stage: The simple sporophyte of Ricciarepresent this stage

Second stage: This stage has been noted in Corsinia.

Third stage: This condition is noted in Sphaerocarpus.

Fourth stage: This stage is represented by Targionia,

Fifth stage: This stage is illustrated by Marchantia,

Sixth stage: This stage is represented by some members of Jungermanniales like Pellia, Riccarclia, etc.

Seventh stage: This stage is illustrated by members of Anthocerotophyta, Anthoceros

Eighth stage (Final stage): The members of Bryopsida like Funaria etc;

(ii) Theory of Regressive evolution i.e. progressive reduction or simplification:

This theory is known as regressive or retrogressive theory. According to this theory, the most simple sporophyte of Riccia is the most advanced type which has been evolved by the simplification or progressive reduction of the complex sporophytes of mosses likeFunaria, Polytrichum etc.

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DEPARTMENT OF **BOTANY**

2022-23

TEACHING NOTES

Paper II-

Basics of Vascular plants and Phytogeography

- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : Classification of Pteridophytes
- Hours Required : 2h
- Learning Objectives : to learn about classification of Pteridophytes
- Previous Knowledge to be reminded : Basics of Pteridophytes
- Examples / Illustrations : Lycopodium, Marsilea
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Pteridophytes
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of charts Any other activity
- Topic Synopsis:
  The Pteridophytes are classified into 4 divisions.

Psilopsida: includes living -Psilotum, as well as fossil plants -Rhynia. The members are sporophytic. Roots are absent. The organization of the plant body of the members is very simple. It is differentiated into a rhizome and an erect aerial portion. Rhizome bears tufts of unicellular Rhizoids. Aerial portion is sparingly or profusely branched. Aerial axis may be leafless or sometimes may bear scaly appendages (e.g., Psilotum) or large foliage leaves (e.g., Tmesipteris). The vascular tissue is of protostele.

Sporangia are borne at the apex of the aerial shoots, they are homosporous. The gametophyte is known only in Psilotum and Tmesipteris (living genera) while unknown in Psilophytales. The gametophyte is cylindrical or branched, subterranean and colourless.

Lycopsida: It includes both fossil –Lepidodendron and living Pteridophytes – Lycopodium. The plant body is sporophytic and can be differentiated into root, stem and leaves. The leaves are small (microphyllous). In some cases the leaves are ligulate (e.g., Selaginella, Isoetes). The ligule is present at the base of each leaf. The vascular tissue may be either in the form of plectostele, siphonostele or sometimes even polystele. Leaf gaps are absent. Sporangia are quite large in size and develop on the adaxial surface of the leaves (sporophylls).

Sporophylls are loosely arranged and form strobilus. Some members are homosporous (e.g., Lycopodium) while others are heterosporous (e.g., Selaginella). Antherozoids are biflagellate or multiflagellate. Gametophytes which are in the form of prothalli are formed by the germination of spores. Heterosporous forms have endoscopic gametophytes while in homosporous forms the gametophyte is exoscopic.

PROFORMA FOR TEACHING PLAN

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- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : General characters of Pteridophytes
- Hours Required : 2h
- Learning Objectives : to learn about characters of Pteridophytes
- Previous Knowledge to be reminded : Basics of Pteridophytes
- Examples / Illustrations : Lycopodium, Marsilea
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Pteridophytes
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of charts Any other activity
- Topic Synopsis :

- The Pteridophytes are the chlorophyllous autotrophic tracheophytic archegoniate and embryophytic vascular cryptogams.They are the first true land
- The plant body of the Pteridophyte is the sporophyte,the dominant generation of the life cylcle differentiated into root(Adventitious)stem and leaves and the gametophyte is thalloid, reduced and independent.
- The stele of the stem ranges from protostele to polycyclic condition
- The leaves are microphyllous or Macrophyllous and the venation is open dichotomous venation.
- In some Pteridophytes the leaves exhibit circinate vernation(Ferns-Pteris)
- The vegetative reproduction is due to the progressive death and decay of the older portions of the stem.
- The asexual reproduction is through spores.
- Some are homosporous (Pteris;lycopodium;Equisetum) and some are Heterosporous (Selaginella)
- The sexual reproduction is of zooidogamous type of oogamy

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(3) Sphenopsida:

It includes both fossil plants (e.g., Calamophyton) as well as living plants (e.g., Equisetum).. The plant body is sporophytic and can be differentiated into root, stem and leaves. Stem is divisible into nodes and internodes and is developed as upright aerial branches from the underground creeping rhizome. Leaves are thin, small, scaly brown and are arranged in transverse whorls on the nodes of the aerial branches. Branches also develop in whorls from the axil of the scaly leaves. As the foliage leaves are reduced to scales, the process of photosynthesis is taken up by the stem and hence it becomes green. The stem has a solid protostele (e.g., Sphenophyllum) or medullated protostele (e.g., Equisetum). Secondary thickenings were observed in some extinct forms (e.g., Sphenophyllum). Sporangia are developed at the apex of the fertile branches in whorls forming compact cone. Living members are homosporous but some fossil forms are heterosporous (e.g., Catamites). Spores germinate to give rise to gametophytes (prothalli) which may be monoecious or dioecious. Antherozoids are large and multiflagellate. Embryo is without suspensor.

4) Pteropsida:

The plants are commonly known as 'ferns'. They occur in all types of habitats and prefer to grow in moist and shady places. The rhizome may be creeping, upright or growing above the soil. Leaves are large, may be simple (e.g., Ophioglossum) or compound (majority of the ferns for example, Pteridium, Marsilea, Adiantum etc.) and described as fronds. Young fronds are circinately coiled. The vascular cylinder varies from a protosete to a complicated type of siphonostele. Vegetative reproduction takes place by fragmentation, stem tubers, adventitious buds or by apogamy (e.g., Marsilea). Sporangia arise from placenta (a swollen cushion of cells) in groups (sori). Sori develop on the margins or abaxial surface of the leaves (sporophylls) or leaflets. Sori are protected by true (e.g., Marsilea) or false indusia (e.g., Adiantum, Pteris).The sporangial development may be leptosporangiate (e.g., Osmunda) or eusporangiate type e.g., Ophioglossum). The sporangia in most cases have a distinct annulus and stomium. Members may be homosporous (e.g., Pteris, Adiantum etc.) or heterosporous (e.g., Marsilea, Azolla, Salvinia etc.) Spores on germination form autotrophic prothalli (gametophyte). Antheridia and archegonia are partially or completely embedded in the gametophyte. Embryo may or may not have suspensor.

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PROFORMA FOR TEACHING PLAN

- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : life cycle of Lycopodium
- Hours Required : 4hrs
- Learning Objectives : to learn about life cycle of Lycopodium
- Previous Knowledge to be reminded : Basics of Pteridophytes
- Examples / Illustrations : L. clavatum, L. cernuum etc.
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Pteridophytes
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of charts Any other activity
- Topic Synopsis:

Lycopodium, commonly known as 'club-moss.

The common Indian species are L. hamilvonii, L. phlegmaria, L. cernuum, L. selago and L. clavatum.

The Sporophyte of Lycopodium:

Habit: weak-stemmed, comparatively small, herbaceous or shrubby sporophytes. Many species are somewhat prostrate with stems creeping above or below the surface of the soil.

Other terrestrial species have upright or semi-erect stems, which later on become more or less horizontal. Some species may also be epiphytic with pendent bodies.

.

The primary root is short-lived but many adventitious..

A cross-section of the stem shows two distinct regions, the cortex and the central cylinder of the stele.

Internal to the pericycle is the central core of vascular cylinder which is a protostele with xylem exarch. In the simplest case, the xylem appears as a star-like mass with a variable number of rays.

In between the rays lies the phloem being separated from the xylem by narrow strip of parenchyma. In more advanced types of sporophytes, numerous furrows appear in the xylem cylinder so that the xylem breaks up isolated strands forming plate-like lobes or mesh-like mass, with included phloem bands.

Reproduction in Lycopodium:

- Lycopodium reproduces both by vegetative and sexual methods.
- **There are several means by which vegetative reproduction takes place:**
- (1) Tips of lateral branches become flattened and with wing-like leaves, known as bulbils or gemmae annually fall to the ground, take roots and form new plants.
- (2) The rhizome progressively grows at the apex and its older part dies, the branches become separated and form new plants.
- (3) In some species during winter the entire plant dies, but the apical portion behaves as a resting bud.
- (4) In epiphytic species, portions of plant body may give rise to new plants.
- (5) Roots and detached leaves of bulbils can also give rise to new individuals.
- Lycopodium is homosporous and the spores are produced within sporangia, borne on the stem, a little above the sporophylls. The sporangium is eusporangiate in development.

- Within the jacket of the sporangium the sporogenous tissue is surrounded by a special nutritive layer known as tapetum. The cells of the sporogenous tissue ultimately cease to divide to form spore mother cells, each of which by reduction division gives rise to a spore tetrad.
- With reduction division and formation of spores, the gametophytic or haploid generation begins. Each spore shows a weak tri-radiate ridge and its wall is either smooth or shows honeycomb or net-like thickenings.
- ***The Gametophyte of Lycopodium:***
- When the spores are mature, a narrow transverse strip of cells (stomium) is gradually differentiated at the apex of the sporangium, which ruptures transversely and liberates the spores. Each spore, under favourable conditions, germinates and produces the gametophytic plant.
There are two main types of gametophytes.
- In tropical species (L. cernuum) usually the spores after liberation germinate quickly and form short-lived gametophytes, on the surface of the ground, which are very small, green (excepting the basal portion), somewhat cylindrical to ovoid bodies with lobed apices.
- In other cases, especially in creeping and epiphytic species (L. clavatum), the spores after a shorter or longer period of rest (3-8 years) germinate and form non-green, subterranean, somewhat tuberous or carrot- shaped, much larger gametophytes, sometimes much convoluted, and these grow to maturity very slowly, taking several years (6-15 years) and nourishing the young sporophytes.
- In other species, transitional forms occur and these gametophytes are partly subterranean with a green, lobed, aerial portion (crown) bearing the sex organs. Usually, both types of gametophytes are associated with an endophytic fungus forming a mycorrhiza, which is a prominent feature of the gametophyte.
- The gametophyte of Lycopodium is monoecious (homothallic) and numerous sex organs, antheridia and archegonia, are borne either on the crown, or in between its lobes, or on the central cushion in flattened types of the gametophytes.
- The antheridia vary in size, shape and number of spermatozoids and either project slightly or remain wholly embedded within the gametophytic tissue. There are many spermatozoid mother cells within the single-layered antheridial wall and each gives rise to a biflagellate (rarely three) spermatozoid resembling the spermatozoid of Bryophyta.
- The archegonia are either short or long and embedded in the tissue of the gametophytes with their necks protruding upwards. At maturity, each archegonium contains an egg cell, a ventral canal cell and 6, sometimes 10-13, canal cells (but only one neck canal cell in shorter archegonium).
- When the archegonium attains maturity its neck canal cells and ventral canal cell disintegrate forming a passage open to the ovum for the spermatozoids to fertilize. The walls of the antheridium breaks up, the spermatozoids are set free, these are washed to the archegonium and one of them, finding its way through the neck, ultimately fertilizes the ovum.
- The fertilized ovum soon covers itself with a wall and forms the oospore. With fertilization and formation of oospore, the sporophytic or diploid generation begins.

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PROFORMA FOR TEACHING PLAN

- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : Pteridophytes-life cycle of Marsilea
- Hours Required : 3hrs
- Learning Objectives : to learn about life cycle of Marsilea
- Previous Knowledge to be reminded : Basics Pteridophytes
- Examples / Illustrations : Cycas
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Pteridophytes
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of charts Any other activity
- Topic Synopsis :

The species of Marsilea possess a rhizome which creeps on or just beneath the surface of the soil.

The rhizome is slender, branched and possesses nodes and internodes.

The leaves are borne alternately along the upper side of the rhizome usually at the nodes.

One or more adventitious roots come out from each node on the underside of the rhizome.

The leaves are borne alternately along the upper side of the rhizome at the nodes.

The leaves possess circinate vernation typical of most Filicales (ferns).

The young parts of the leaves of M. minuta and others are covered with numerous multi-cellular hairs.

The rhizome of Marsilea possesses an amphiphloic siphonostelic vascular cylinder.

The outermost layer is the single- layered epidermis without any stomata.

The cortex is differentiated into outer and inner cortical regions.

Sporocarp: It is developed on base of the petiole.

It has sporangia 1. Microsporangia and 2. Megasporangia. Producing microspores and megaspores respectively.

Sporangia are protected by true inducium.

Spores give rise to dioecious gametophyte. The gametophyte is endosporic.

Fertilization require water. Zooidogamous oogamy. Zygote develops into new sporophyte.

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PROFORMA FOR TEACHING PLAN

- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : Gymnosperms –General characters.
- Hours Required : 2h
- Learning Objectives : to learn about General characters
- Previous Knowledge to be reminded : Basics Gymnosperms
- Examples / Illustrations : Cycas, Pinus, Gnetum.
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Gymnosperms
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of chartsAny other activity
- Topic Synopsis

Characteristics of Gymnosperms

ollowing are the important characteristics of gymnosperms:

1. They do not produce flowers.
2. Seeds are not formed inside a fruit. They are naked.
3. They are found in colder regions where snowfall occurs.
4. They develop needle-like leaves and pinnately compound leaves..
5. They are perennial or woody, forming trees or bushes.
6. They are not differentiated into ovary, style and stigma.
7. Since stigma is absent, they are pollinated directly by the wind.
8. The male gametophytes produce two gametes, but only one of them is functional.
9. They form cones with reproductive structures.
10. The seeds contain endosperm that stores food for the growth and development of the plant.
11. These plants have vascular tissues which help in the transportation of nutrients and water.
12. Xylem does not have vessels and the phloem has no companion cells and sieve tubes.

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PROFORMA FOR TEACHING PLAN

- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : Gymnosperms -Cycas
- Hours Required : 2h
- Learning Objectives : to learn about Cycas Morphology
- Previous Knowledge to be reminded : Basics Gymnosperms
- Examples / Illustrations : Cycas
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Gymnosperms
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of chartsAny other activity
- Topic Synopsis :

- The term stele was derived from Greek language which means central piller.The stelar theory was proposed by Van Tiegham and Douliot.
- The structural unit of the stele is vascular strand.
- The most primitive and simplest stele is proto stele in which a solid core of xylem is surrounded by phloem core (adult stems of Lycopodium;Selaginella.
- The haplostele contains a central solid and smooth core of xylem surrounded by concentric layers of phloem(Rhynia;Horneophyton)
- Actinostele consists of xylem in the form of radiating arms and the phloem in isolated patches alternating with the xylem (Psilotum ;Lycopodium serratum).
- Some times the actionstele may show variations due to breaking of the xylem tissue into different forem. They are Plectostele –The xylem occurs in the form of small parallel plates alternating with the phloem plates; Mixed proto stele – The masses of xylem and phloem are uniformly distributed.
- Siphonostele a protostele with medulla.
- In Ectophloic siphonostele the centrally located pith is surrounded by the concentric rings of xylem and phloem(Osmunda).
- In Amphiphloic siphonostele the phloem is found on the inner as well as outer side of the xylem cylinder(adiantum and Marsilea).
- In Eustelic siphonostele has vascular bundles arranged in the form of ring (Equisetum).Solenostele may be ectophloic or amphiphloic.Dictiostele become broken into meresteles (Pteris;Polypodium)

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PROFORMA FOR TEACHING PLAN

- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : Gymnosperms -Cycas
- Hours Required : 2h
- Learning Objectives : to learn about Cycas Morphology
- Previous Knowledge to be reminded : Basics Gymnosperms
- Examples / Illustrations : Cycas
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Gymnosperms
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of charts
- Any other activity :
- Topic Synopsis :

Cycas is a gymnosperm. It is the only living genus identified in the family Cycadaceae. It contains more than 100 species. It is mainly distributed in the eastern and southeastern asian regions. Many Cycas species are native to China, Australia and India.

Cycas are perennial evergreen trees. They appear like a palm tree. They are characterised by the presence of naked seeds, i.e. ovules are not enclosed within the ovary. The main body part is the diploid sporophyte. Cycas are dioecious, i.e. the male and female plants are separate. The main plant body of Cycas is a diploid sporophyte. It is a vascular plant and is differentiated into roots, stems and leaves. Some of the important features of Cycas are:

It is an evergreen and perennial plant. Some species grow as tall as 40 feet in height. It is a dioecious plant, i.e. male and female reproductive parts are borne on different trees. It possesses two kinds of roots, tap root and coralloid root. The primary roots are tap roots. The main functions of these roots are anchorage and absorption of water and minerals. The coralloid roots develop from the normal roots.

The coralloid roots are associated with cyanobacteria that perform biological nitrogen fixation. The stem or caudex is mostly unbranched, thick and woody. The surface of the stem is rough due to persistent leaf bases. Leaves form a crown at the top of the stem.

The green foliage leaves are pinnately compound. Each leaf has multiple leaflets, which are arranged on a long rachis. The leaves have circinate vernation. The foliage leaves are not permanent and fall off, leaving leaf bases. Xylem contains tracheids but lacks vessels. Phloem consists of sieve tubes and phloem parenchyma. Companion cells are absent. They show secondary growth.They are heterosporous.. The sporangia are borne on spirally arranged megasporophylls and microsporophylls. The megasporophyll does not form a cone.

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PROFORMA FOR TEACHING PLAN

- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : Gymnosperms –Cycas life cycle.
- Hours Required : 2h
- Learning Objectives : to learn about Cycas Reproduction
- Previous Knowledge to be reminded : Basics Gymnosperms
- Examples / Illustrations : Cycas
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Gymnosperms
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of charts
- Topic Synopsis :

Reproduction and Life Cycle

Cycas shows vegetative as well as sexual reproduction. Sexual reproduction occurs through the formation o seeds. The adventitious buds or bulbils develop in the axils of scaly leaves. They detach from the stem an develop into new plants. The bud from the male plant develops into a male plant and the bud from the femal plant develops into a female plant. Cycas is heterosporous. It produces two kinds of spores. It is dioecious, i.e male and female reproductive parts are borne on different plants. The sexual reproduction is oogamous, i.e the egg is quite large in size and non-motile compared to male gametes. The microspores are produced in the microsporangia, which are borne on microsporophylls. Microsporophylls are arranged spirally in the acropeta succession on the axis to produce a cone or compact strobili. The male cone of Cycas is the largest in the plan kingdom.

The microspores are haploid and produced by meiosis in microspore mother cells. Microspores develop into male gametophytes, which are reduced and are called pollen grains. The development of pollen grains is initiated within the sporangia. The microsporangia dehisce at the 3-celled state of pollen grains that consist o a prothallial cell, a generative cell and a tube cell. Further development of the male gametophyte occurs after pollination. Pollen grains are wind pollinated.

Pollen grains are carried towards the ovule by air. The pollen tube grows towards the archegonia in the ovules and discharges its contents , i.e. male gametes, near the mouth of the archegonia. The zygote gives rise to the embryo and the ovule develops into a seed.

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PROFORMA FOR TEACHING PLAN

- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : Gymnosperms – Gnetum life cycle
- Hours Required : 2h
- Learning Objectives : to learn about Gnetum life cycle
- Previous Knowledge to be reminded : Basics Gymnosperms
- Examples / Illustrations : Gnetum montana, G.ula etc.,
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Gymnosperms
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of charts
- Topic Synopsis :

The Sporophyte of Gnetum:

The plants are mostly lianes (G. ula), few species are small trees (G. gnemon) and shrubs. The leaves are simple, large, oval, entire, exstipulate, leathery, petoiate, reticulate, venation opposite-decussate

The branches are of two kinds:

One of limited growth or dwarf shoot, and

The other of unlimited growth or long shoot.

In transverse section of a young stem of Gnetum the epidermis, cuticularized; sunken stomata are present. The cortex is many-layered and consists of polygonal or rounded parenchyma cells with chloroplasts.

The phloem consists of sieve-tubes, phloem parenchyma and well- developed phloem fibres. The xylem is endarch and made up mainly of tracheids and a few vessels or trachea. Secondary growth in the stems of Gnetum takes place in the normal fashion. In the case of lianes, secondary growth anomalous.

A transverse section of a young root of Gnetum exhibits the following structure – the epiblema is single-layered , the cortex and stele with diarch xylem.

A cross-section of the leaf of Gnetum seems to differ in no essential feature from that of a dicotyledon.

In Gnetum the microsporophylls and megasporophylls form different strobili and the plants are mostly dioecious.

Staminate (or Male) Strobilus:

Staminate strobilus is a cone-like structure formed by the aggregation of several pairs of decussate bracts on, a slender axis. It is axillary or terminal, solitary or catkin-like cluster. The bracts are connate throughout and look like small cups. In the cups stamens are present. As the microsporangia mature, all the cells between the microspores and the epidermis break, and the microspores are liberated.

Ovulate Strobilus:
The structure of the ovulate strobili resembles, in general, that of the staminate strobili, but are compound, since the m sporangia or ovules are borne on the secondary axis. Though there are numerous ovules, only a few attain maturity.

Each ovule is invested with two integuments; the inner one becomes prolonged into a micropylar tube. The MMC divide meiosis to form one functional megaspore.

Gametophytes of Gnetum:

Male Gametophyte:
At the time of germination of the pollen grain, which takes place inside the pollen chamber, the exine is cast off and the intine is pushed out in the form of pollen tube. The tube nucleus is the first to enter the pollen tube and is followed later by the generative cell. The generative cell finally divides to form two male cells.

Female Gametophyte:
Megaspore developed into female gametophyte having egg, but no archegonia

Fertilization in Gnetum:
Siphonogamous oogamy

The New Sporophyte of Gnetum:
After fertilization, the zygote develops into the embryo.

A mature seed is usually elongated but may be slightly oval also. Its colour varies from green to red. The endosperm is ver conspicuous and remains enveloped by three envelopes. The cotyledons are two in number.

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- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : Gymnosperms -Cycadeoidales
- Hours Required : 2h
- Learning Objectives : to learn about Cycadeoidales
- Previous Knowledge to be reminded : Basics Gymnosperms
- Examples / Illustrations : Cycas
- Additional Inputs : Pictures and photographs
- Teaching Aids Used : Charts and photographs
- References Cited : The Morphology of Gymnosperms
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of charts
- **Topic Synopsis**

The Cycadofilicales, they formed the dominant fossil plants during Palaeozoic age.

Morphology: In Cycadeoidea the stem was un-branched with a single crown of pinnate leaves at the tops, but some species had branched stem with a multiple crown. In some the stem was tuberous. In all cases the stem was covered up by persistent leaf bases as we find in Cycas.

Anatomy: In structure the stem usually had large pith and thin vascular cylinder in which the protoxylem was endarch, thick cortex with a number of gum canals in it. There was small amount of secondary growth. Growth rings were only in few cases where the cambium persisted and was more active, so on the whole the stem anatomy was like those of present day cycads i.e., with large pith, broad cortex and narrow vascular cylinder.

Leaves of Cycadeoideales:

The leaves in Cycadeoidea (Bennettites) were large pinnate and showed xerophytic features. The vascular bundles in petiole and leaflets were mesarch with a strong sheath of sclerenchyma around it. Bipinnate leaves were rarely found in Cycadeoidea so the form and structure of leaf is practically like that of living cycads.

Fructification in Cycadeoideales:

The fructification in Cycadeoidea was bisporangiate. The strobili were developed in the upper part of the plant in large numbers. The whole of the strobilus and the bases of leaves were covered up by large sized scales.Each strobilus was made up of a number of heavy imbricate reduced leaves or bracts. These bracts completely surrounded the strobilus when it was the earliest stage of development where the strobilus developed these imbricate bracts separated and the inner part of the strobilus exposed.

The second whorl was made up of a number of leaf like microsporophylls, all of which were united at the base to form a cup-shaped structure round the central part of strobilus. The third central portion was hemispherical or dome-shaped in appearance. The central part was made up of a number of ovulate sporophylls. These megasporophylls were simply stalked.

At the tip of the stalk was developed an ovule. Some stalks were sterile and the tips of sterile stalks were flattened. The central stalks stood up vertically upward and they were longer in length.

The lateral ones continue to decrease in size from above downwards and stood projecting from lateral side, so the ripe female portion of strobilus hemispherical or dome-shaped in appearance. It is clear that in this bisporangiate strobilus the stamens or microsporophyll's ripe first at which time the ovules were immature.

When the ovules matured the stamens were shed, so in the strobilus in which the ovules were ripe the microsporophyll's were absent but in young strobilus both were present.

The microsporophyll's or the stamens were 10 or 20 in number. These microsporophyll's or stamens were all united at the base and each stamen was pinnate in form and on each stamen there were about twenty slender pinnae on either side, under the pinnae were developed two rows of fused sporangia or synangium had a short stalk and two pollen sacs in it; so each stamen was pinnate in form and was very much like the Marattious ferns in which we know the sporangia fuse to form synangia.

When stamens were very young they rolled downwards; so on the whole we can say that the stamens of Cycadeoidea (Bennettites) were very much like those of ferns, while in living gymnosperms they have lost their resemblance with the ordinary ferns.

The central portion was dome-shaped in form and this part was made up of a number of slender stalks, the central ones were long and stood vertically upwards, the lateral ones short and they diverged outwards. On the whole the female part was oblong in shape. Some of the stalks bore ovules while the others were sterile and their tips were expanded.

The male and female parts of strobilus were separated by the presence of some sterile bracts or scales. The ovule was orthrotropous and terminal. It was small in size and was surrounded by three-layered testa like that of Cycas. The nucellus was spearate from integuments only in the upper part the integument projects forward to form a long micropyle.

At the base of the micropyle the nucellus projected to form nucellus beak and round the base of nucellus beak there was a depression, the pollen chamber.

During the development of seed it appears that there was no suspensor developed. It might have been developed in the earlier stages of development of seed, but it is doubtful, so Cycadeoideales (Bennettitales) differ from other gymnosperms in these two important respects- 1. The non-formation of suspensor and 2. The presence of a non-albuminous dicot embryo

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PROFORMA FOR TEACHING PLAN

- Name of the Dept/Subject : Department of Botany (Botany)
- Name of the lecturer : P. Sudhakar
- Course/Group : I BSc BZC
- Paper : Semester – II
- Name of the topic : Geological time table
- Hours Required : 2h
- Learning Objectives : to learn about Geological time table
- Previous Knowledge to be reminded : Fossils, carbon dating
- Examples / Illustrations : Cycadeoidea
- Additional Inputs : carbon dating
- Teaching Aids Used : Charts and photographs
- References Cited : The General ecology by H.D. kumar
- Student activity planned after teaching : Class room discussion
- Activities planned outside the class : Preparation of charts

	YEARS IN MILLION	PERIOD	EPOCH	FAUNA	FLORA
Cenozoic	1	Quaternary	Recent (Holocene)	Age of Mammals	Angiosperms Monocotyledons
	6		Pleistocene	Age of Human beings	Age of Angiosperms - Dicotyledons
	10	Tertiary	Pliocene	Human evolution	
	15		Miocene	Mammals and birds	
	20		Oligocene		
	100		Eocene		
			Paleocene		
Mesozoic	125	Cretaceous		(Golden age of Reptiles) Rise of Dinesurs	Sphenopsides, Ginkgos, Gnetales, (Dicotyledons)
	150	Jurassic			Herbaceous lycopods, Ferns, Conifers, Cycads
	180	Triassic			
Paleozoic	205	Permian		Mammal like reptiles	Arborescent lycopods
	230	Carboniferous	Pennsylvanian	Earliest reptiles	Seed ferns and Bryophytes
	255		Mississippian	Earliest Amphibians and abundant Echinoderms	
	315	Devonian		Age of fishes	Progymnosperms
	350	Silurian		Earliest fishes and land invertebrates	Zosterophyllum
	430	Ordovician		Dominance of invertebrates	Appearance of first land plants
	510	Cambrian		Fossil invertebrates	Origin of algae
Proterozoic	3000	Upper		Multicellular organisms	
		Middle		Appearance of eukaryotes	
		Lower			Planktons prokaryotes

PROFORMA FOR TEACHING PLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	BASICS OF TAXONOMY
Hours required	2h
Learning objectives	to know Taxonomic resources
Previous Knowledge to be reminded	Taxonomic resources
Examples/ Illustrations	Herbaria
Additional Inputs	Field experience
Teaching aids used	Black board
References Cited	Taxonomy of flowering Plants, Eurasia Publishing House, New Delhi. Porter, C.L.
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	Field observation
Any other activity	Collection of plant materials

Topic Synopsis:

Taxonomical aids are the collections of samples or preserved organisms which help in extensive research for identification of various taxonomic hierarchy. Classifying organisms into various categories needs a lot of field a laboratory study. This is an essential process, because taxonomic categorization helps in identifying many organisms necessary in various fields like agriculture, industries, bio resources, etc.The taxonomical Aids are the main source whi helps us in studying the relative level of a group of organisms, their taxonomic hierarchy and the taxonomic rank.

Taxonomical Aids are required for:Taxonomic studies of various species of plants, animals, and other organisms, whic require correct classifications and identification. Identification of organisms requires laboratory and field studies.

Herbarium: It is a store that houses a collection of preserved plant species. Plant specimens are preserved in forms herbarium sheets which are prepared by drying, pressing and preserving the samples on sheets. These sheets are the arranged in their order of classification in the taxonomic hierarchy. These herbarium sheets carry all the information abou the respective specimen.

Botanical garden: These are gardens in which specific plants are grown and are labelled according to their taxonomy Thus, the labels carry their scientific names and family. The main purpose of botanical gardens is to identify the plan species under consideration.

Museum: Biological museums are found in schools and colleges; like the biology laboratory that we find in our schools In these museums, plants and animal species are preserved in jars and containers with the help of appropriate preservatives. They may also be dried and preserved. Birds and larger animals are usually stuffed before preserving and insects are killed and pinned in the boxes. We sometimes find skeletons of various animals too.

Key: This is a taxonomical aid where plants and animals are recognized based on contrasting characteristics known as keys. Two contrasting keys are generally kept as a pair, thus leading to acceptance of one and rejection of another.

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PROFORMA FOR TEACHING PLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	BASICS OF TAXONOMY
Hours required	2h
Learning objectives	to know Botanical Nomenclature
Previous Knowledge to be reminded	Botanical Nomenclature
Examples/ Illustrations	Binomial nomenclature
Additional Inputs	Field experience
Teaching aids used	Black board
References Cited	Taxonomy of flowering Plants, Eurasia Publishing House, New Delhi. Porter, C.L.
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	Field.observation
Any other activity	Collection of plant materials

Topic Synopsis:

Botanical nomenclature is the systematic or scientific naming of plants. That means the name assigned to a particular plant species is based on the rules within the botanical nomenclature system, particularly the International Code of Nomenclature for algae, fungi, and plants (ICN). Binomial nomenclature is related to taxonomy, which is the science of finding, describing, classifying, and naming organisms, including the studying of the relationships between taxa and the principles underlying such a classification.

Thus, plant taxonomy, in particular, is a broader field and is primarily focused on the grouping and classifying of plants. Botanical nomenclature is concerned with simply naming the plants. Nevertheless, the name given to a particular plant species (called botanical name) includes the genus it belongs. There are also botanical names that are comprised of two parts, i.e. the genus name and the specific epithet. The genus name in the botanical name of a plant species is the first part whereas the specific epithet is the second part. For example, Musa acuminata (a banana species native in Southeast Asia) is comprised of the genus name Musa and the specific epithet acuminata.

A separate code is also used for the "Prokaryotes" (including the bacteria) and viruses Code of Botanical Nomenclature. A person who publishes a scientific name is considered the author of that name, though citation of the author's name is optional. The author's name is not italicized, and follows the italicized scientific name. For names published by Linnaeus that are still valid, the author is designated as "L."

Vernacular names may be genus or family names and should be written in all lowercase letters. Vernacular names are not capitalized unless they are proper nouns. When the vernacular name does not reflect the correct taxonomic position of the plant, join the terms with a hyphen. However, it should be noted that this rule is practiced inconsistently.

Valid scientific names should not be synonyms or homonyms. However, synonyms and homonyms do exist for scientific and vernacular names. Multiple names used for the same species (synonyms) or names that sound the same but represent different species (homonyms) pose problems in consistency and in retrieval of data and should be avoided if possible.

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PROFORMA FOR TEACHING PLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	BASICS OF TAXONOMY
Hours required	2h
Learning objectives	to know .Types of classification
Previous Knowledge to be reminded	Types of classification
Examples/ Illustrations	Types of classification
Additional Inputs	Field experience
Teaching aids used	Black board
References Cited	Taxonomy of flowering Plants, Eurasia Publishing House, New Delhi. Porter, C.L.
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	Field observation
Any other activity	Collection of plant materials

Topic Synopsis:

Taxonomic entities are classified in three ways. They are artificial classification, natural classification and phylogene classification.

Artificial system of classification: Carolus Linnaeus (1707 - 1778) was a great Swedish Botanist and said to be the "Father of Taxonomy." He outlined an artificial system of classification in "Species Plantarum" in 1753, wherein he liste and described 7,300 species and arranged in 24 classes mostly on the basis of number, union (adhesion and cohesion), length, and distribution of stamens. The classes were further subdivided on the basis of carpel characteristics into orders. Hence the system of classification is also known as sexual system of classification. This system of classification though artificial, was continued for more than 100 years after the death of Linnaeus, due to its simplicity and easy way of identification of plants.

Natural system: Botanists who came after Linnaeus realised that no single character is more important than the othe characters. Accordingly an approach to a natural system of classification sprouted in France. The first scheme o classification based on overall similarities was presented by Antoine Laurent de Jessieu in 1789. A widely followe natural system of classification considered the best was proposed by two English botanist George Bentham (1800 - 1884 and Joseph Dalton Hooker (1817–1911). The classification was published in a three volume work as "Genera Plantarum (1862–1883) describing 202 families and 7569 genera and 97, 205 species. In this system the seeded plants were classified into 3 major classes such as Dicotyledonae, Gymnospermae and Monocotyledonae.

Phylogenetic system of classification: The publication of the Origin of Species (1859) by Charles Darwin has given stimulus for the emergence of phylogenetic system of classification. Engler and Prantl system of classification: One of the earliest phylogenetic system of classification in a monumental work "Die Naturelichen Pflanzen Familien" in 23 volumes (1887- 1915) In this system of classification the plant kingdom was divided into 13 divisions. The first 11 divisions are Thallophytes, twelfth division is Embryophyta Asiphonogama (plants with embryos but no pollen tubes; Bryophytes and Pteridophytes) and the thirteenth division is Embryophyta Siphonogama (plants with embryos and pollen tubes) which includesseedplants.

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PROFORMA FOR TEACHING PLAN

Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	SYSTEMATIC TAXONOMY
Hours required	2h
Learning objectives	to know Asclepiadaceae
Previous Knowledge to be reminded	Asclepiadaceae
Examples/ Illustrations	Asclepiadaceae
Additional Inputs	Chart
Teaching aids used	Black board
References Cited	Taxonomy of flowering Plants, Eurasia Publishing House, New Delhi. Porter, C.L.
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	Field observation
Any other activity	Collection of plant materials

Topic Synopsis:

Characters of Asclepiadaceae: Habit: The plants of this family are mostly erect herbs or woody climbers but some are succulent.

Root system: The members of this family have tap root system. Perennial root stock is commonly present and sometimes the roots are fleshy and tuberous.

Stem: Stem is erect, branched and woody in lower portions. The vascular plants are bi-collateral and the plants contain milky juice present in branching laticiferous tubes.

Leaves: The leaves are simple, sub-sessile and exstipulate. In many cases the leaves are fleshy and covered with a coating of wax, e.g., Calotropis. In Stapelia, the leaves are very much reduced and represented by spines and scales.

Inflorescence:

The inflorescence is usually a dichasial cyme, arising in the leaf axil or sometimes it is a racemose or umbellateas in Asclepias and Calotropis.

Flower: The flowers are perfect, hermaphrodite, bracteates, bracteolate, complete, bisexual, actinomorphic, pentamerous and hypogynous. The flowers are comparatively large in Stapelia.

Calyx: The calyx consists of five sepals which are united below to form short calyx tube. It shows imbricate or valvate type of aestivation.

Corolla: The corolla has five united petals (gamopetalous) which may be rotate (Calotropis) or companulate or funnel form. They show valvate or twisted aestivation. The corolla tube is in the form of corona with ring of hairs or scale. In Ceropegia the straight or curved corolla is swollen at the base. The corolla lobes are valvate or generally twisted to right. The corolla tube is with a corona which is in the form of a ring of hairs.

Androecium: Stamens are five, epipetalous and inserted at or near the base of the corolla tube. The filaments may be free or may be united to form a tube round the style.

Gynoecium: The gynoecium is bicarpellary and the ovaries of the two carpels are free. The styles are united at their apices and the stigma has five lateral surfaces. pendulous ovules on marginal. Pollination: entomophily. **Fruit**: The fruit is of two follicles which are close together or divergent. They vary in shape and are membranous to woody.

Seed: The seeds are flattened and commonly bear a terminal tuft of white long silky hair. They help in dispersal. The endosperm is dense and embryo is large

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PROFORMA FOR TEACHING PLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	SYSTEMATIC TAXONOMY
Hours required	2h
Learning objectives	to know Amaranthaceae
Previous Knowledge to be reminded	Amaranthaceae
Examples/ Illustrations	Amaranthaceae
Additional Inputs	Chart
Teaching aids used	Black board
References Cited	Taxonomy of flowering Plants, Eurasia Publishing House, New Delhi. Porter, C.L.
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	Field observation
Any other activity	Collection of plant materials

Topic Synopsis:

Root: A branched tap root.

Stem: Aerial, herbaceous or woody, erect or straggling, cylindrical, or angular, branched, solid, hairy, green or striped green.

Leaves: Simple, alternate or opposite, petiolate, exstipulate, reddish in colour, unicostate reticulate venation.

A. **Floral characters: Inflorescence:** Axillary or terminal spikes (Achyranthes, Digera). Some times in cymose panicles. Flower: Bracteate, sessile or sub-sessile, bracteolate, bracteoles two, actinomorphic, hermaphrodite or unisexual hypogynous, small inconspicuous, green or variously coloured. Perianth: Usually five tepals, free or united, sometimes two or three (Amaranthus), dry membranous, valvate or twisted, sometime, hairy, green or coloured, persistent, inferior.

Androecium: Stamens 5 or 3 (Amaranthus), free or united, staminodes sometimes present, introrse, dithecous or monothecous (Alternanthera). In Achyranthes 5 fimbriated scales alternate with 5 fertile stamens.

Gynoecium: Bicarpellary, or tricarpellary; syncarpous, ovary superior, unilocular, usually one campylotropous ovule; basal placentation; style short or filiform; stigma 2 or 3. **Fruit**: Dry one seeded achene or several seeded capsule or one to several seeded berry.

Seed: Endospermic with polished testa, kidney-shaped embryo curved. Pollination: Mostly anemophilous and in some plants entomophilous.

Economic importance:

Seeds of Amaranthus caudatus are edible. Amaranthus cruentus and A. frumentacea are raised as cereals by primitive tribes in Tropical Asia. The leaves of Amaranthus viridis, A. spinosus and A. tricolor are also used as vegetables. Achyranthes aspera is diuretic and purgative.

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PROFORMA FOR TEACHING PLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	SYSTEMATIC TAXONOMY
Hours required	2h
Learning objectives	to know Ephorbiaceae
Previous Knowledge to be reminded	Ephorbiaceae
Examples/ Illustrations	Ephorbiaceae
Additional Inputs	Chart
Teaching aids used	Black board
References Cited	Taxonomy of flowering Plants, Eurasia Publishing House, New Delhi. Porter, C.L.
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	Field observation
Any other activity	Collection of plant materials

Topic Synopsis:

Distribution: All these species are distributed in tropical and sub-tropical Himalayas and mountain ranges of south India.
Vegetative characters Habitat: Generally, plants belonging to this family are Mesophytic or xerophytic in habitat
Habit: This family shows a great range of characteristics in vegetative and floral structures. Members of this family are mostly shrubs (for example Jatropa, Ricinus, Euphorbia sps.) or trees (for example Emblica officinalis, Hevea brasiliensis) and rarely herbs (for example Acalypha, Phyllanthus).
Root system: These plants show tap root system. Exceptionally, Manihot has tuberous roots w hich are rich in starch. Few species of Manihot are edible.
Stem: Several species of Euphorbia are cactus-like in habit with thick and fleshy stems and leaves reduced to spines. These plants often contain milky latex with special laticiferous vessels.
Leaf: The leaves are usually alternate or rarely opposite (Choriophyllum) or whorled (Mischodon), simple, entire or deeply palmately lobed (Ricinus and Jatropa) or compound (Bischofia). The leaves are variegated in Croton.

Inflorescence: Inflorescence is complex and highly variable. In Phyllanthus, the flowers are solitary or auxiliary. In Croton, the inflorescence is panicle. In Acalypha, it is catkin and in Jatropa the flowers are arranged in terminal cymose.

Flower: The flowers are unisexual, bracteates, actinomorphic, regular, pentamerous or trimerous (Phyllanthus), monochlamydeous and hypogynous..

Perianth: Perianth is mostly in one whorl, green or rarely petaloid (Manihot). Rarely perianth is in two whorls as in Jatropa or absent as in Euphorbia. In Jatropa, both calyx and corolla are present. Aestivation is valvate or imbricate type.

Androecium: The Androecium show variable number of stamens. In male flowers they range from one to many arranged in one to ten whorls. Filaments are free or united. The anthers are monothecous or dithecous, erect and dehisce longitudinally or transversely.

Gynoecium: The gynoecium is tricarpellary, syncarpous with superior, trilocualr ovary. Axile placentation.. Fruit: Fruit is usually three chambered, schizocarpic.

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PROFORMA FOR TEACHING PLAN	
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Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	SYSTEMATIC TAXONOMY
Hours required	2h
Learning objectives	to know Arecaceae
Previous Knowledge to be reminded	Arecaceae
Examples/ Illustrations	Arecaceae
Additional Inputs	Chart
Teaching aids used	Black board
References Cited	Taxonomy of flowering Plants, Eurasia Publishing House, New Delhi. Porter, C.L.
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	Field observation
Any other activity	Collection of plant materials

Topic Synopsis: **Distribution:** Generally distributed in tropical and sub-tropical parts of the world.

Habitat: They are mostly mesophytes and some xerophytes are also found in this family. Habit: These plants a generally woody shrubs or trees or sometimes vines (Calamus) with usually unbranched, slender to stout stem to over meters tall..

Root system: Fibrous and adventitious root are seen in this family which arise from the base of the stem. Some specie also have prop roots (Iriartea)

Stem: Stem is variable in different forms such as very short with leaves appearing to arise from ground, thin and slende with long internodes and tall, stout, pillar-like covered by persistent leaf-bases and terminal cluster of leaves. Stems are rarely branched.

Leaf: Leaves are palmate (fan palms) or pinnate (feather palms) and rarely simple. Leaves are usually large with petiole base sheathing the stem. Leaf is usually terminal cluster. Petiole is large and venation is parallel type.

Inflorescence: Inflorescence is usually large, much branched, paniculate or spadix.

Flower: Flowers are ebracteate, sessile, actinomorphic usually unisexual and monoecious but sometimes even dioecious They are rarely bisexual, trimerous, cyclic (usually), or partially acyclic, hypogynous.

Perianth: Perianth is 6 in number free or united in 2 whorls of 3 each. They are usually tough, leathery and usually persistent. In the bud condition, they are imbricate, valvate and twisted.

Androecium: Androecial members free of the perianth, or adnate to the perianth. Total 6 stamens are arranged in 2 whorls of 3 each. Androecium consists exclusively of fertile stamens, or may also include staminodes.

Gynoecium: The gynoecium is present only in pistillate or bisexual flowers. Ovary is tricarpellary, unilocular, apocarpous or syncarpous.. The ovary may or may not have style. Stigma is dry-type. Single ovule per locule is place on sub-apical or basal placentation. **Pollination**: anemophilous.

Fruit: Fruit is a berry with fleshy or non-fleshy exocarp or a drupe with fibrous epicarp. Fruit is always single seeded with small embryo and abundant endosperm

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PROFORMA FOR TEACHING PLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	SYSTEMATIC TAXONOMY-II
Hours required	2h
Learning objectives	to know Poaceae
Previous Knowledge to be reminded	Poaceae
Examples/ Illustrations	Poaceae
Additional Inputs	Chart
Teaching aids used	Black board
References Cited	Taxonomy of flowering Plants, Eurasia Publishing House, New Delhi. Porter, C.L.
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	Field observation
Any other activity	Collection of plant materials

Topic Synopsis:

Distribution: The Graminae family is also known as grass family. There are about 530 genera and 5200 species. Habit/habitat: Annual herbs or sometimes perennial shrubs, mesophytic, wild or cultivated

Root: Fibrous root and branched or adventitious

Stem: Erect or prostrate, runner, aerial, herbaceous or woody, fistular or solid, cylindrical, glabrous or hairy, branched or unbranched.

Leaf: Exstipulate, sessile, simple, alternate, leaf is divided into two parts. Lower part is thick leaf sheath, which covers internode, and upper part is thin leaf blade. parallel venation.

Inflorescence: Spike or panical of spikelet. Each spikelet consists of sterile bract called glume. Each glume is boat shaped with thick mid nerve.

Flowers: Bracteate, sessile, incomplete, hermaphrodite, rarely unisexual, sygomorphic, hypogynous. Each flower consists fo two covers the outer lemma and inner palea

Perianth: When calyx and corolla is not differentiated then it is called perianth. It is represented by two or three membranous lodicules.

Androecium: Stamens 3 or 6, polyandrous. Anther – dithecus, versatile

Gynoecium: Carpel – 1, monocarpellary, sometimes carpels – 3, tricarpellary, syncarpous. Ovary – superior, unilocular, basal placentation. Stigma – feathery and bifid. **Fruit:** caryopsis. **Seed:** endospermic, monocotyledonous

Economic Importance of Poaceae: The staple food grains of the population of world are derived from Oryza sativa (Rice) and Triticum aestivum (Wheat). They are cultivated from time immemorial. Food: Triticum aestivum, Oryza sativa, *Zea mays* (Maize), Hordeum vulgare (Jaw), Sorghum vulgare (Jowar), Avena sativa (Oats), Pennisetum typhoides (Bajra) are cultivated for cereals and food grains. Fooder:Many grasses as Cynodon dactylon,. Sugar: Saccharum.

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Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	Phytogeography
Hours required	2h
Learning objectives	to know Principles of Phytogeography
Previous Knowledge to be reminded	Interaction between plants growing in a community
Examples/ Illustrations	plant examples
Additional Inputs	Photographs
Teaching aids used	Black board
References Cited	Cain, S.A : Foundations of Plant Geography
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	observation
Any other activity	Information collection

Topic Synopsis:

Principles of Phytogeography: Phytogeography (from Greek phytón = "plant" and geographía = "geography" meaning also distribution) or botanical geography is the branch of biogeography that is concerned with the geographic distribution of plant species and their influence on the earth's surface. Phytogeography is concerned with all aspects of plant distribution, from the controls on the distribution of individual species ranges (at both large and small scales, see species distribution) to the factors that govern the composition of entire communities and floras

I. Principles concerning environment: The distribution of plants is primarily controlled by climatic conditions. The relations between land masses and seas have varied in the past. The large land masses split up to form new land masses or continents which separated and reoriented. Land bridges between continents acted as probable routes for migration of plant and animal species. The land bridges became submerged in sea with the passage of time and the possibility for migration of plants and animals from one continent to another disappeared for ever. Soil conditions on plains and mountains of different land masses show secondary control on distribution of vegetation

II. **Principles concerning plant responses**: Range of distribution of plants is limited by their tolerances. Each plant species has a range of climatic and edaphic conditions. Therefore, tolerance of a large taxon is the sum of tolerances of its constituent species. Tolerances have a Genetic basis. The response of plants to environment is governed by their genetic makeup. Many of the crops through breeding and genetic changes have been made to grow in wider range of environmental conditions. In nature, hybrid plants have been found to have wider range of tolerances than their parents. 9. Different ontogentic phases have different tolerances. Different developmental stages of plants show different degree of tolerances, as for example seeds and mature plants are more tolerants to temperature and moisture variations than their seedlings.

III. **Principles concerning the migration of floras and climaxes**: Large scale migrations have taken place. The fossil and palaeoecological evidences reveal that large scale migrations of plants and animals have taken place during Mesozoic era and Tertiary periods. Migration resulted from transport and establishment. In the process of migration plants are dispersed to new habitats through their propagules such as spores, seeds, bulbils etc., and there they are established if environmental conditions are favourable. Plants grow and reproduce there and progeny perpetuates through ecological adjustments.

IV. Principles concerning the perpetuation and evolution of floras and climaxes: Perpetuation depends first upon migration and secondly upon the ability of species to transmit the favourable variations to the progenies.

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➢ PROFORMA FOR TEACHING PLAN

Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	Phytogeography
Hours required	2h
Learning objectives	to know Endemism – types and causes
Previous Knowledge to be reminded	Endemism – types and causes
Examples/ Illustrations	plant examples
Additional Inputs	Photographs
Teaching aids used	Black board
References Cited	Cain, S.A : Foundations of Plant Geography
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	observation
Any other activity	Information collection

Topic Synopsis:

Endemism – types and causes:

Endemism means the confinement of a particular species, genus, or groups of plants and animals to a particular area. Taxa occurring only a single restricted geographical area is known as endemics, Endemism normally applied only where there is a considerable restriction in the area of distribution.

Types of Endemism:

(a) **Neo-endemism**:A taxon is evolutionarily young and not yet spread over the new area e.g., Senecia combrensis. (b) Palaeo-endemism: The taxon is restricted now but once it was widely distributed. The restriction of species in a pocket is due to physical barrier like deserts mountain, sea, etc. or change in climate or soil type etc. (c) Epibiotics or Relic, endemics:

(b) The plants belong to fossil groups and are restricted to few pockets due to favorable climate, lack of competition e.g., Ginkgo biloba which is restricted to China but widely spread in the north temperate zone as a fossil, Sequoiadendron giganteum is now restricted to Californian Sierra Nevada.

According to Richardson (1978) endemics is intermediate between the two extremes i.e., plants which are not of recent origin but have retained a narrow distribution and he called them Holoendemics. If the local conditions induce reactivation of Palaeoendemics evolving new endemic species after a long gap they are called active epibiotics.

(a) **Schizoendemics:** Derived from or having given rise to a more widespread taxon of same chromosome number.

(b) **Patroendemics**: Restricted diploids which have given rise to widespread polyploids.

3. **Characters of Endemics:** 1. They are localized in distribution because of their Narrow Ecological Amplitude and are unable to invade in fresh areas. 2. They lack potentially to migrate because of saturate genomes. 3. Real endemics never migrate while Neoendemics have the potential to migrate. 4. The dispersal propagules are not able to sustain during migration to other area. It may be due to physical barriers.

4.**Theories of Endemism:** There are 2 main theories of Endemism. The first theory believes that the last survivors of once flourishing flora which is now declining are the relics or epibiotics which are endemics. However, second theory believes that these are recent and youthful forms in course of gradual extinction. The theory is also known as Age and Area hypothesis.

5. **Factors Responsible for Endemism**:

Factors responsible for the production of endemics are Natural crossing among the closely related plants growing under favourable conditions and Mutations. If the condition of isolation is developed the effect become more pronounced.

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➢ PROFORMA FOR TEACHING PLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	Phytogeography
Hours required	2h
Learning objectives	to know Phytogeographic regions of India.
Previous Knowledge to be reminded	Phytogeographic regions of India.
Examples/ Illustrations	plant examples
Additional Inputs	Photographs
Teaching aids used	Black board
References Cited	Cain, S.A : Foundations of Plant Geography
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	observation
Any other activity	Information collection

Topic Synopsis: Phytogeographic regions of India.:

1. **Western Himalayas**: The northern part of our country is bounded by highest ranges of Himalayas and is one of the important botanical regions of the world with climate and vegetation ranging from truly tropical near the low altitudes to temperate arctic types at the high altitudes. The northern mountain division can phytogeographically be divided into western, central and eastern zones.

2. **Eastern Himalayas**: Eastern Himalayas extend from Sikkim to upper Assam, Darjeeling and NEFA. Vegetation of this region differs from that of western Himalayas. The chief differences are due to changed environmental factors as heavy monsoon rainfall, less snowfall and high temperature and humidity**. 3. Indus Plains**: It includes part of Punjab, Rajasthan, Cutch, Delhi, a part of Gujarat. Some part of this plain is now in Pakistan. The climate of this zone is characterised by dry hot summer, and dry cold winter. Rainfall is usually less than 70 cms, but in certain regions it is as low as 10-15 cms. The soil of a wide area except cultivated land, is saline. Much of the land has become desert due to excessive dryness.

4. **Gangetic Plains:** This is one of the richest vegetational zones in India. This zone covers flat land of a part of Delhi, whole of U.P., Bihar, and West Bengal and also a part of Orissa. Rainfall in this zone is from 50 cm to 150 cm. A great part of the land is under cultivation. The common crop plants are wheat, barley maize. Sorghum (jowar), Bajra, urad, Moong (Phaseolus mungo), Cajanus cajan, til (Sesamum indicum), sugarcane. Pea (Pisum sp.), gram (Cicer arietinum), potato, Brassica, rice.

5. **Central India:** Central India covers Madhya Pradesh, part of Orissa (now Odisha), Gujarat and Vindhya. The areas are hilly. The average rainfall per annum may be 100-170 cm. Some places are at the altitudes of 500-700 m from the sea level. Biotic disturbances are very common in this botanical province which have led to the development of the thorny vegetation in open areas. In this region teak (Tectona grandis) and sal (shorea robusta) forests are very common. Other trees are Terminalia tomentosa, Bauhinia, Mango, Phyllanthus, Ficus glomerata, etc. Among common shrubs are Mimosa rubricaulis, Desmodium, Acacia sp., Zizyphus rotundifolia and other.

6. **Deccan:** This region comprises whole of the southern peninsular India including Satpura and southern part of Godawari River. Average annual rainfall in this region is about 100 cm. 7. **Western Coast of Malabar:** This is small botanical province covering Cape Comorin to Gujarat and Western Ghats. This is a region of heavy rainfall.

8. **Assam:** This botanical province is very rich in vegetation and covers valley of Brahmaputra, Naga hills and Manipur. This is the region of heaviest rainfall. Cherapunji is one of the rainiest place in the world where annual rainfall often exceeds 1000 cm. Excessive wetness and high temperature in this zone are responsible for the development of dense forests. Broad leaved, tall evergreen angiosperms and some conifers are very common in the forests.

9. **Bay Islands of Andaman and Nicobar (India): Islands:** These are represented by the Andaman and Nicobar Islands in the east and Lakshadweep islands in the west.

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➢ PROFORMA FOR TEACHING PLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	P. Sudhakar
Course/ Group	BZC
Paper	Paper – II
Name of the topoic	Phytogeography
Hours required	2h
Learning objectives	to know Vegetation types in Andhra Pradesh
Previous Knowledge to be reminded	Vegetation types in Andhra Pradesh
Examples/ Illustrations	plant examples
Additional Inputs	Photographs
Teaching aids used	Black board
References Cited	Cain, S.A : Foundations of Plant Geography
Study activity planned after teaching	Group discussion/ Class room quiz
Activity planned outside the class	observation
Any other activity	Information collection

Topic Synopsis:

Vegetation types in Andhra Pradesh.:

The state of Andhra Pradesh is considered one of the rich bio-diversified states in India. Natural vegetation (flora) and animal life (fauna) depend mainly on climate, relief, and soil. Krishna and Godavari are the two largest rivers flowing through the state.

The Andhra Pradesh Forest Department deals with protection, conservation and management of forests. The Eastern Ghats region is home to dense tropical forests, while the vegetation becomes sparse as the Ghats give way to the Deccan Plateau, where shrub vegetation is more common.

The varied diversity of fauna includes Bengal tiger, Indian leopard, hyenas, blackbucks, sambars, and sea turtles. The state government declared certain areas as wildlife sanctuaries and national parks

National parks and zoo parks: Indira Gandhi Zoological Park is located in Visakhapatnam. It is one of the largest zoos of India, spread over an area of 625 acres (253 ha). It was named after Indira Gandhi, the former Prime Minister of India and was opened in 1977. There are eighty species with 800 animals. Hippopotamus and crocodiles are the special animals conserved

Wildlife sanctuaries: Kambalakonda Wildlife Sanctuary, Visakhapatnam Coringa Wildlife Sanctuary a Mangrove Forest Coringa Wildlife Sanctuary a Mangrove Forest Kambalakonda Wildlife Sanctuary is situated on NH 5, surrounded by the Eastern Ghats on three sides and the Bay of Bengal on the fourth. It houses Indira Gandhi Zoological Park. The Park has almost eighty species with primates, carnivores, mammals, ungulates, reptiles and birds.

Papikonda Wildlife Sanctuary is located in East Godavari, West Godavari in an area of 591 km2 (228 sq mi). Fauna found in this sanctuary are tigers, panthers, gaur, cheetal, chowsingha, sambar, blackbuck, mouse deer, barking deer, sloth bears, wild ogs, hyenas, jackals, wild boar, marsh crocodiles and a variety of birds

Coringa Wildlife Sanctuary is located in East Godavari district in an area of 235.70 km2 (91.00 sq mi). It has the rare, endangered smooth Indian otter, fishing cat and estuarine crocodile.

Krishna Wildlife Sanctuary is a wildlife sanctuary and estuary located in Krishna district of Andhra Pradesh.

Bird sanctuaries: Atapaka Bird Sanctuary, also known as Kolleru Wildlife Sanctuary (see also Kolleru Bird Sanctuary), is a largest freshwater lake located in West Godavari district.

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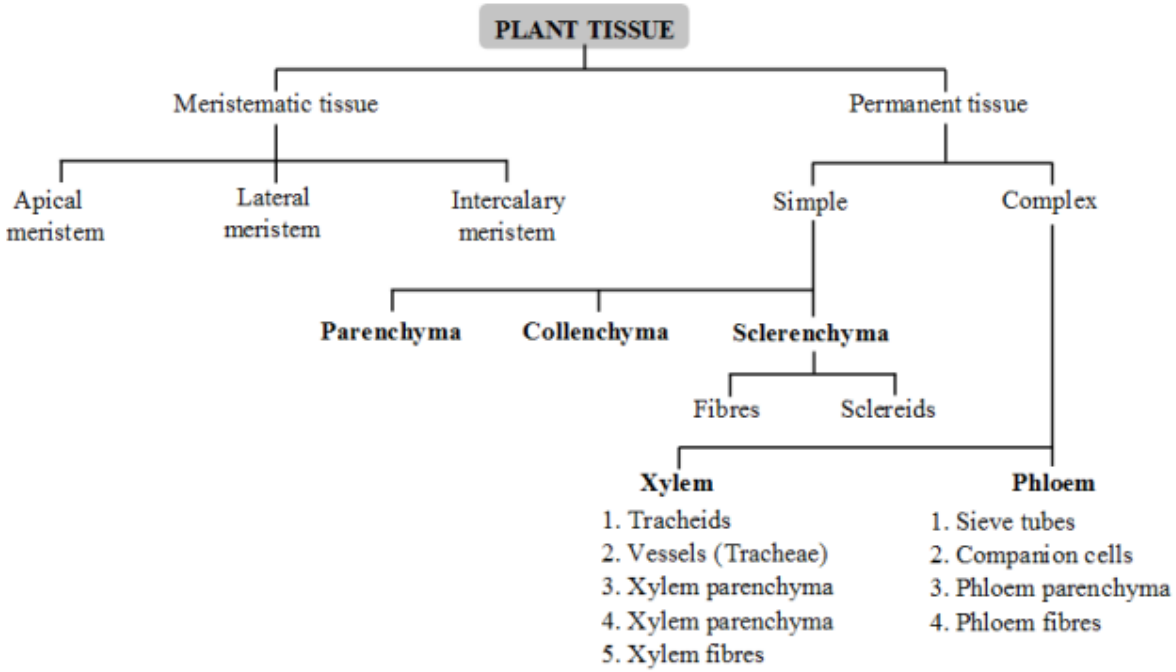
DEPARTMENT OF BOTANY

TEACHING NOTES (2022-23)

Paper III-***Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity***

Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	Plant Tissues--Meristem or Meristematic Tissue
Hours Required	
Learning Objectives	To know the different types of Plant tissues and their functions
Previous Knowledge to be reminded	Cell structure and functions
Examples/Illustrations	Different plant parts
Additional Inputs	Flash cards
Teaching Aids Used	B.B&PPT
References Cited	Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA. Fahn, A. (1990) Plant Anatomy
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	



Meristem or Meristematic Tissue--

. Meristmatic cells have some characteristics like:

- Meristematic cells may be rounded, oval or isodiametric in shape.
- Compactly arranged i.e. no intercellular space and with dense cytoplasm
- Large nucleus, and small vacuoles or without vacuoles
- Cell wall is thin and donot store reserve food material
- Always in active state of division and divide in a plane.

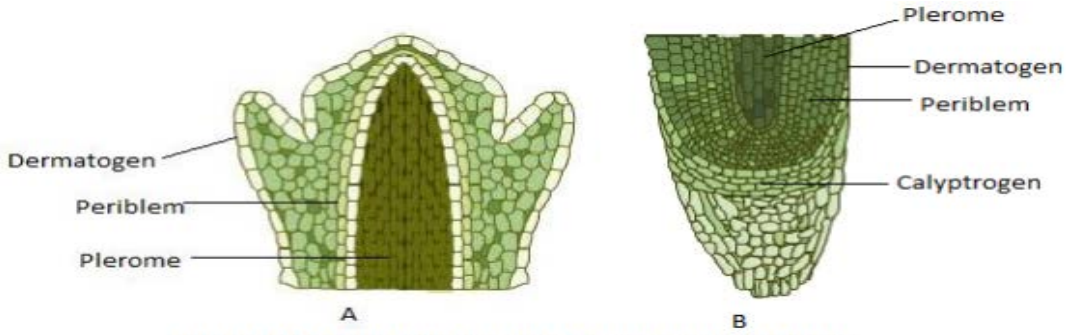


Fig.2.1: Meristematic tissue: A. Stem apex; B. Root apex

Types of Meristem:

- ***Promeristem***:
- **Primary Meristem**:.
- **Secondary Meristem**:

On the basis of position in plant body the meristem is of following type:

- Apical Meristem:
- Intercalary Meristem:.
- **Lateral Meristem**:

Based on Division

- **Mass Meristem**:
- **Plate Meristem**
- **Rib or File Meristem**:

Based on Function

Protoderm
Procambium-
Pround meristem-

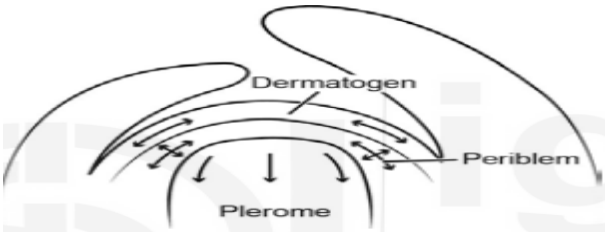
Structure and Organisation of Shoot Apex

- Apical theory
- Histogen Theory
- Tunica-Corpus theory

Apical Theory

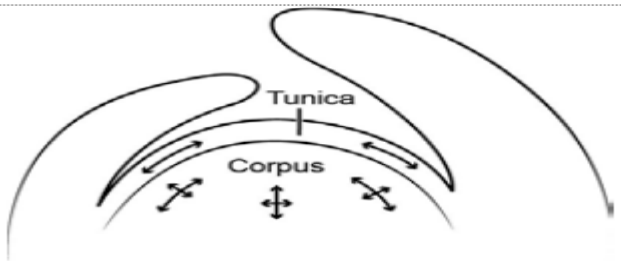
This theory was given by Karl Nageli and Hofmeister. According to this theory, a single apical cell is responsible for the development of all the aerial plant parts. This theory holds good for some cryptogams, such as bryophytes, some higher algae and some pteridoph

Histogen Theory



i: Shoot apex organizations as proposed by Hanstein.

Tunica-Corpus Theory



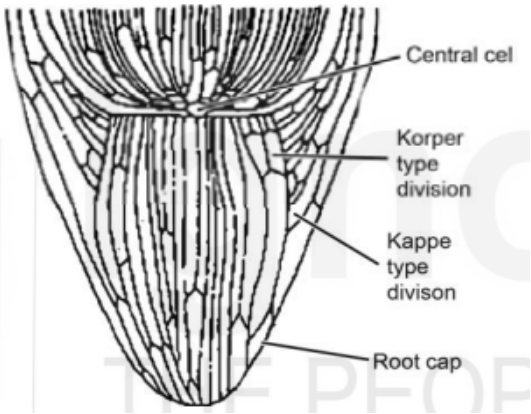
Representation of the shoot apex according to Tunica corpus concept.

THEORIES OF ROOT APICAL ORGANISATION—

-Apical Cell Theory

-Histogen Theory

-Korper-Kappe Theory



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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	Plant Tissues--Meristem or Meristematic Tissue
Hours Required	
Learning Objectives	To know the different types of Plant tissues and their functions
Previous Knowledge to be reminded	Cell structure and functions
Examples/Illustrations	Different plant parts
Additional Inputs	Flash cards
Teaching Aids Used	B.B&PPT
References Cited	Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA. Fahn, A. (1990) Plant Anatomy
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

Epidermal tissue system--

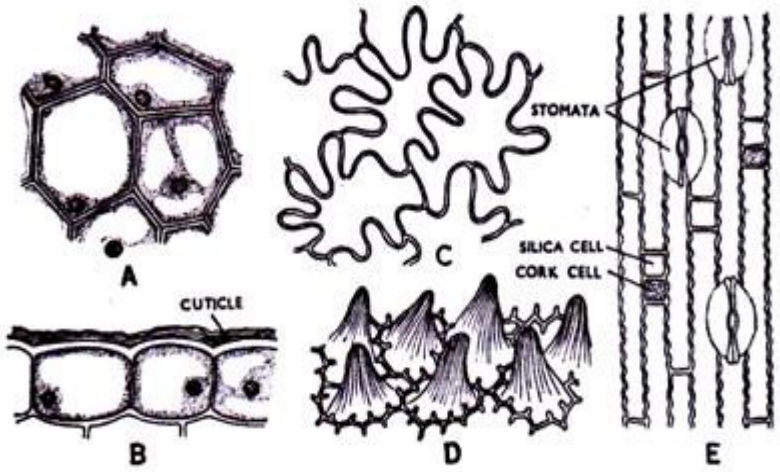

FIG. 555. Epidermal cells. A. Ordinary epidermal cells from a leaf in surface view. B. Same in sectional view. C. From leaf of *Solanum* (potato) in surface view. D. From the petal of *Viola* showing ridge-like infoldings of lateral walls and protruding papillae. (*After Strasburger*). E. Of *Saccharum* (sugar-cane) with silica cells and cork cells.

Cuticle-

Bulliform Cells-

Stomata-

Epidermal Outgrowths or Trichomes-

On the basis of morphological characters, trichomes are classified into several types. Important among them are hairs and scales.

1. Hairs

Hairs are the common type of trichomes. They may be unicellular or multicellular.

Unicellular hairs

Multicellular hairs

2. Scales
3. Root Hairs

Function of Epidermis Tissue System--

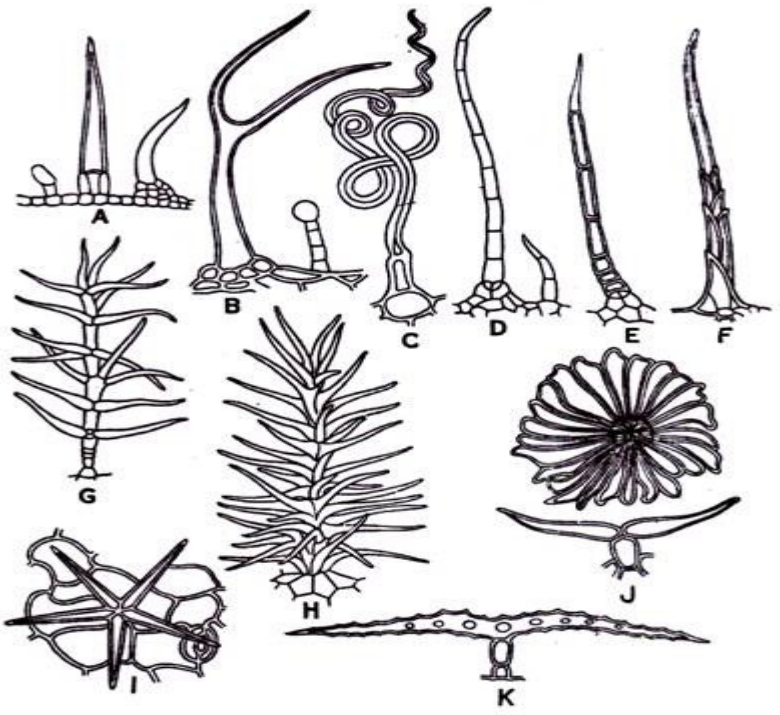

Fig. 564. Epidermal hairs—different types. A. Sharp hairs of *Lantana*. B. Lobed hair of *Amaranthus*. C. Wooly hair of *Banksia*. D. Of *Lycopersicum* (tomato). E. Of *Helianthus* (sunflower). F. Of *Mimosa*. G. Dendroid hair of *Platanus*. H. Same of *Mimosa* spp. I. Stellate hair of *Althaea* (Malvaceae). J. Peltate hair in surface and side view of *Olea*. K. T-shaped hair of *Dicrasus*

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	**Ground Tissue System**
Hours Required	
Learning Objectives	To know the different types of Plant tissues and their functions
Previous Knowledge to be reminded	Cell structure and functions
Examples/Illustrations	Different plant parts
Additional Inputs	Flash cards
Teaching Aids Used	B.B&PPT
References Cited	Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA. Fahn, A. (1990) Plant Anatomy
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

This tissue system includes all the tissues excepting the epidermis and vascular bundles. Therefore, it is the largest tissue system beginning from the layer next to epidermis and continuing up to the centre point of the organ. Ground tissue system is heterogeneous in nature including diverse types of cells specialised for different types of function.The ground tissue outside the stele is called the cortex or extrastellar ground tissue and that inside the stele is called intrastellar ground tissue or pith.

Cortex—Endodermis --Pericycle --Pith --Medullary Rays:

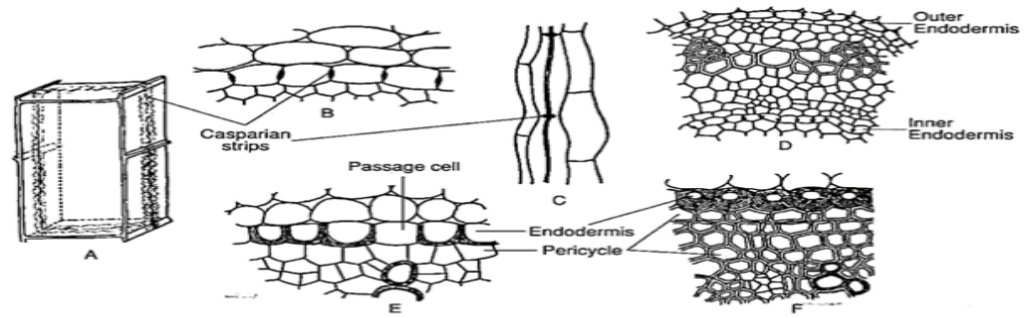

Fig. 5.83 : Endodermis : A. Diagram of a cell showing casparian strip. B. Endodermal cells in t.s. C. Same in L.S. D. Transverse section of the rhizome of *Marsilea* showing the outer and inner endodermis. E. Thick-walled endodermis in root of maize with passage cell. F. Same in the root of *Smilax*

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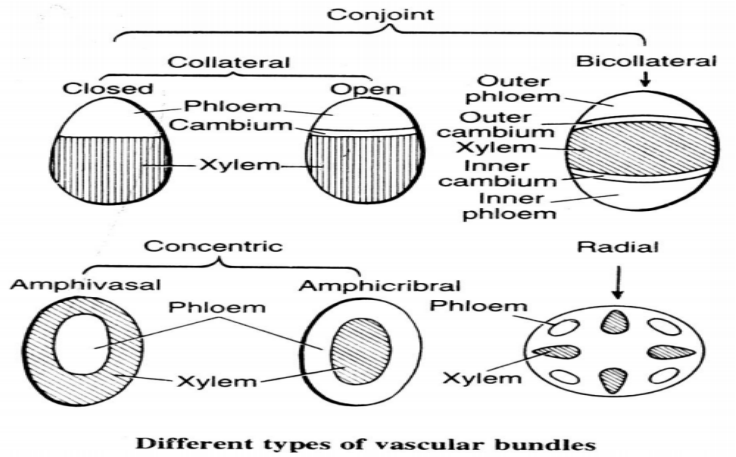
Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	**Vascular Tissue System**
Hours Required	
Learning Objectives	To know the different types of Plant tissues and their functions
Previous Knowledge to be reminded	Cell structure and functions
Examples/Illustrations	Different plant parts
Additional Inputs	Flash cards
Teaching Aids Used	B.B&PPT
References Cited	Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA. Fahn, A. (1990) Plant Anatomy
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

Vascular Tissue System

Type Of Vascular Bundles

1. Collateral vascular bundle
2. Bicollateral vascular bundle
3. Concentric vascular bundle
Amphicribral bundle
Amphivasal bundle
4. Radial vascular bundle



Different types of vascular bundles

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	Anomalous Secondary Growth InBoerhaavia
Hours Required	
Learning Objectives	To know the different types of Plant tissues and their functions
Previous Knowledge to be reminded	Cell structure and functions
Examples/Illustrations	Different plant parts
Additional Inputs	Flash cards
Teaching Aids Used	B.B&PPT
References Cited	Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA. Fahn, A. (1990) Plant Anatomy
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

Anomalous Secondary Growth In Boerhaavia--

Boerhaavia is a member of family, Nyctaginaceae.
They are generally herbaceous plant.
Boerhaavia Stem - Transverse section through the young stem of Boerhaavia show following tissues :

- Epidermis –
-Cortex –
-Stele

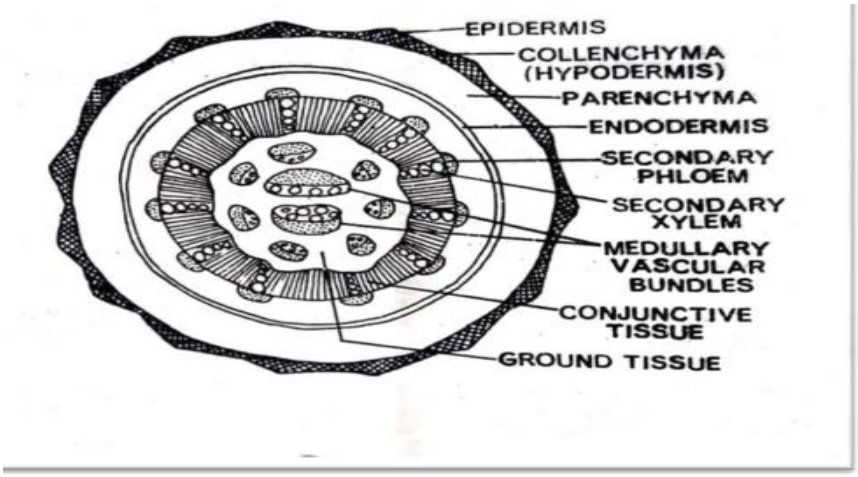
Vascular System - Vascular bundles are collateral, conjoint and open with endarch xylem and are arranged in three rings –
1) Two large centrally placed medullary vascular bundles.
2) A middle ring of 6 to 14 loosely arranged and medium sized vascular bundles.
3) The outer ring of 15 to 20 small vascular bundles just beneath the pericycle.

Anomalous Structure In Boerhaavia –

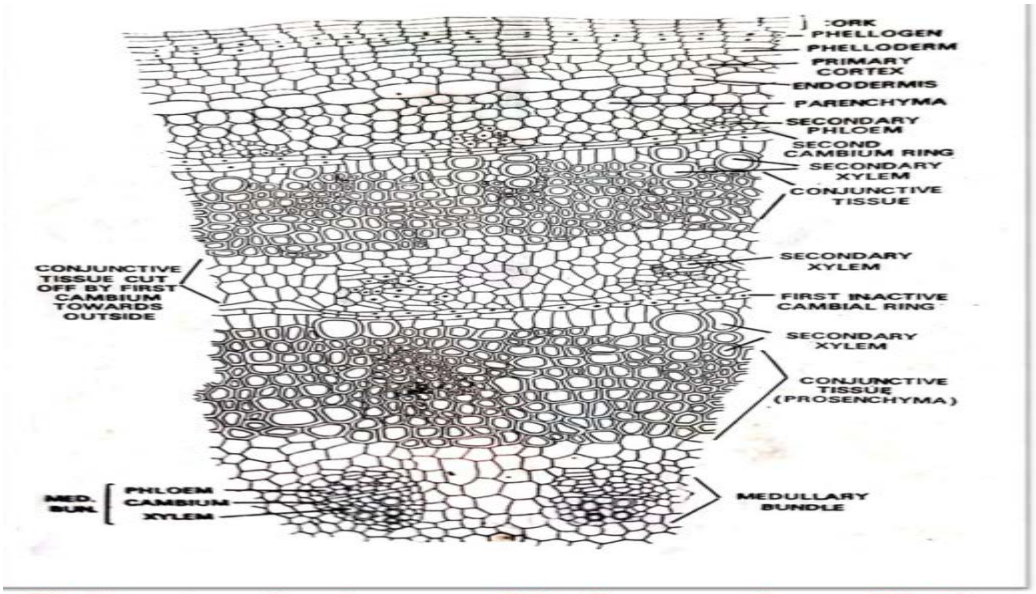
a) Primary Anomaly - Presence of two large central medullary vascular bundles encircled with a second ring of 6 to 14 loosely arranged vascular bundles lying in the ground tissue.
b) Non-adaptive type Anomaly - Normal indisposition of cambium with its unusual activity.

Anomalous Secondary Growth –

The stem of Boerhaavia contain well defined anomalous secondary growth which is characterized by the presence of successive rings of xylem and phloem (vascular bundles).



- *Boerhaavia* Stem - T.S. of Stem of *Boerhaavia* sp. (Diagrammatic)



- The Stem Anomalous Structure - T.S. of a sectore of stem of *Boerhaavia diffusa* showing anomolus secondary growth, thick-walled conjunctive

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	Anomalous Secondary Growth in Dracaena
Hours Required	
Learning Objectives	To know the different types of Plant tissues and their functions
Previous Knowledge to be reminded	Cell structure and functions
Examples/Illustrations	Different plant parts
Additional Inputs	Flash cards
Teaching Aids Used	B.B&PPT
References Cited	Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA. Fahn, A. (1990) Plant Anatomy
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

Anomalous Secondary Growth in Dracaena—

Dracaena is a typical example of anomalous secondary growth in monocots.
Typically, secondary thickening is absent in monocots. Therefore, secondary thickening itself is an anomaly as Dracaena is a monocot.
The following features of the stem-
¬ Epidermis single layered remains covered with thick cuticle.
¬ Hypodermis is sclerenchymatous.
¬ Numerous closed, collateral vascular bundles scattered in the parenchymatous ground tissue. ¬ Xylem is endarch.

Anomalous structure:

Dracaena shows anomalous secondary growth.
The cambium appears in the parenchyma outside the outermost vascular bundles. This region in which the cambium appears in sometimes as cortex and some times as pericycle.
--The newly formed cambium cuts towards both outside and inside.
• Inner side of the cambium is usually differentiated into vascular bundles remain separated from each other by lignified tissue, sometimes this tissue remain unlignified and thin walled.
• Outer side of the cambium make parenchyma
• The palm stem do not increase in girth because of any cambial activity but tis thickening is the result of gradual increase in size of the cells and of intercellular spaces and sometimes of the proliferation of fibre tissues.
• This is the type of long continuing primary growth.
• The activity of the primary thickening meristem resembles with secondary growth found in certain monocotyledons such as Dracaena.
• A cambium ring is formed due to meristematic activity of some cells lying immediately outside the bundles.

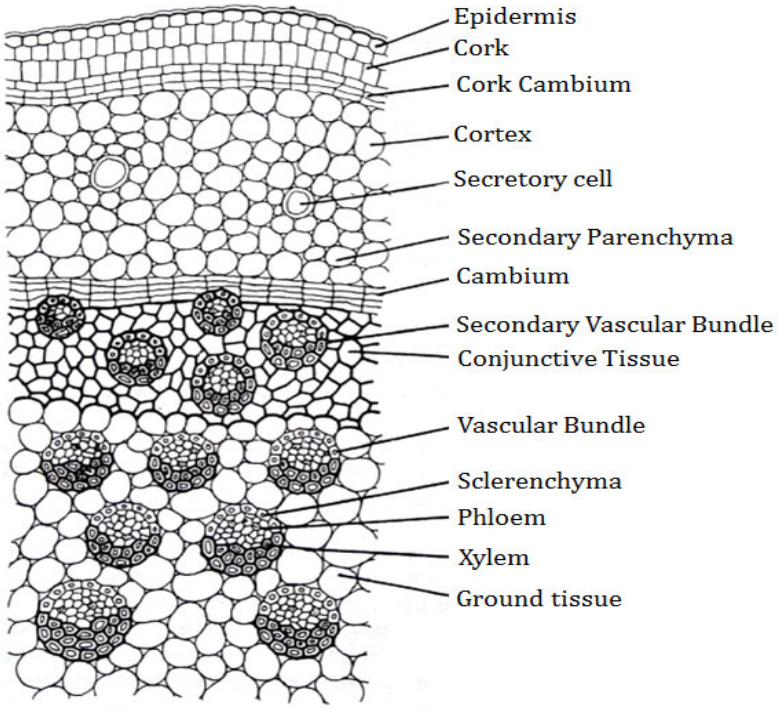
The cambium cells are unusual in function, which go on producing secondary vascular tissues and conjunctive parenchyma internally and little simple parenchyma externally.

• The secondary vascular bundles formed are oval and amphivasal and are smaller than the primary bundles.

• They embedded in the conjunctive tissue whose cells are radially arranged.

• In the extra stelar region is formed because of the repeated periclinal divisions of the cortical cells.

• The cork cells, formed without the appearance of cork cambium are called storied cork.



Anomalous Secondary Thickening in *Dracaena (Diagram)*

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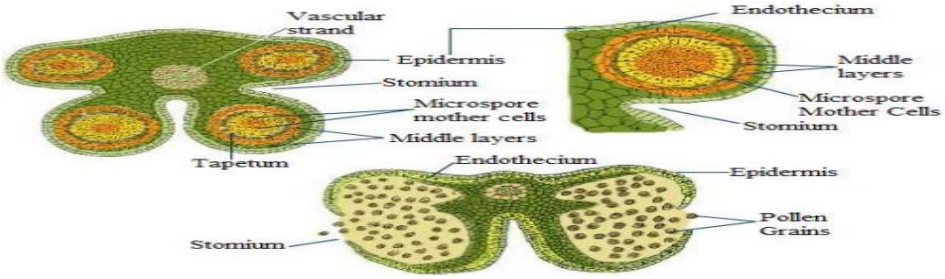
Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	STRUCTURE OF ANTHER
Hours Required	
Learning Objectives	To understand---- • What is male gametophyte? • Name the first cell of male gametophyte • difference between the terms sporogenesis and microsporogenesis? •development of male gametophyte in Angiosperms?
Previous Knowledge to be reminded	Flower structure
Examples/Illustrations	Different types of Flowers
Additional Inputs	Flash cards
Teaching Aids Used	B.B&PPT
References Cited	Pandey, A. K. (2000) Introduction to Embryology of Angiosperms.
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Diagrams practice
Any other activity	
Synopsis	

STRUCTURE OF ANTHER—

It consists of two parts, outer wall and central homogeneous mass of sporogenous tissue. Microsporangial wall has four types of layers:

1. Epidermis (common anther covering) 2. Endothecium

3. 2-3 middle layers and 4. Tapetum



MICROSPOROGENESIS---

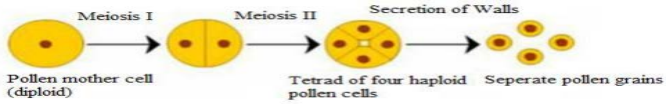


Fig. 5.7: Microsporogenesis

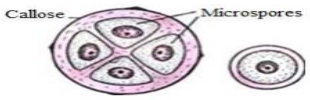
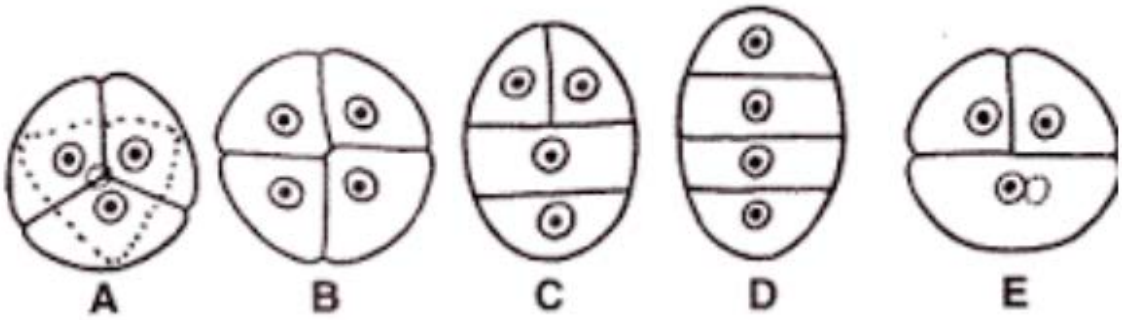


Fig. 5.8: Microspores showing callose wall

Microspore tetrads--

--decussate,
--linear and
----T-shaped tetrads are also found.



DEVELOPMENT OF MALE GAMETOPHYTE IN ANGIOSPERM

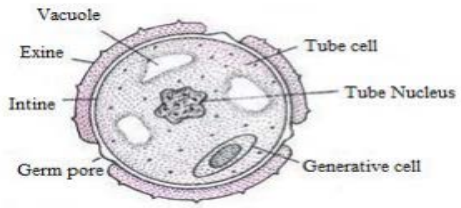
Microspore/Pollen grain:

Pollen grains are contained in the microsporangia (pollen chamber). They are very minute in size (approximately 0.025 to 0.125 mm) and are like particles of dust. A freshly formed pollen grain is richly cytoplasmic with a prominent, centrally located nucleus. The wall of the mature pollen grain is stratified. It comprises of two layers. The outer layer is called exine and inner layer is termed as intine. The term exine and intine were proposed by Fritsch (1837).

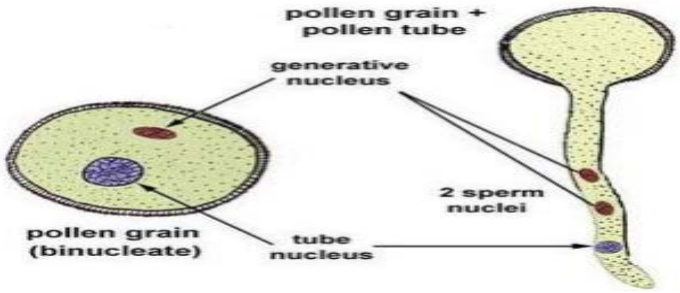
Exine: Thick, tough cutinized layer which is often provided with spinous outgrowths or sometimes smooth. The exine is composed of a complex substance, called sporopollenin.

Intine: It is thin, smooth, delicate pecto-cellulosic layer lying internal to the exin

Pre-pollination development ---



Post-Pollination development ---



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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	FEMALE GAMETOPHYTE
Hours Required	
Learning Objectives	To understand---- What is ovule? • How many types of ovule are there and on what basis they are differentiated? • What is megasporogenesis? • difference between female gametophyte or embryo sac? • Why embryo sacs are classified as monosporic, bisporic or tetrasporic?
Previous Knowledge to be reminded	Flower structure
Examples/Illustrations	Different types of Flowers
Additional Inputs	Charts
Teaching Aids Used	B.B& PPT
References Cited	Pandey, A. K. (2000) Introduction to Embryology of Angiosperms.
Student Activity Planned after teaching	Group Discussion
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

FEMALE GAMETOPHYTE—

STRUCTURE OF OVULE--

Parts of the ovule: 1. Funiculus or Funicle: A stalk by which ovule is attached to the placenta

2. Nucellus: the body of ovule

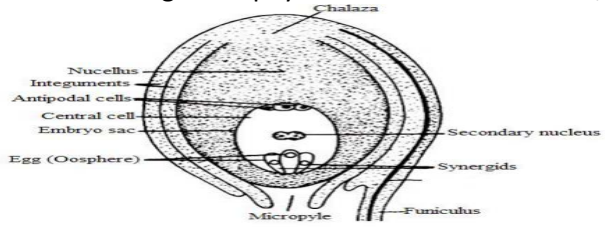
3. Integument: the protective covering of nucellus

4. Micropyle: small opening formed by two integuments over nucellus

5. Chalaza: basal part of the ovule

6. Hilum: region where ovule fuses with funiculus

7. Embryo sac: female gametophyte located in the nucellus, developed from megaspore



Types of ovule

On the basis of the position of the micropyle with respect to the funiculus, mature ovule can be classified into six main types. These are:

1. Orthotropous 2. Anatropous 3. Campylotropous 4. Amphitropous
5. Hemianatropous 6. Circinotropous

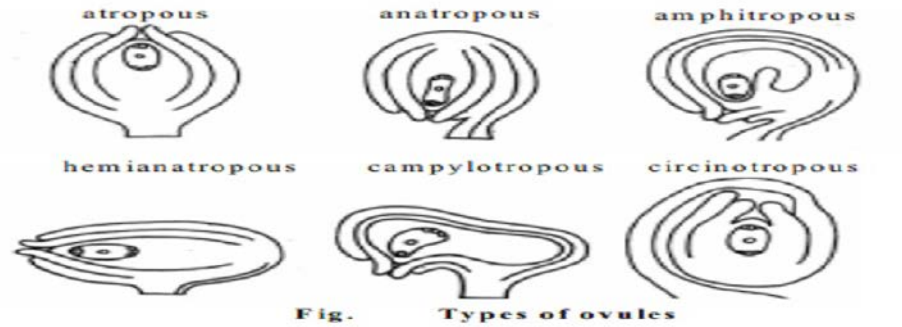
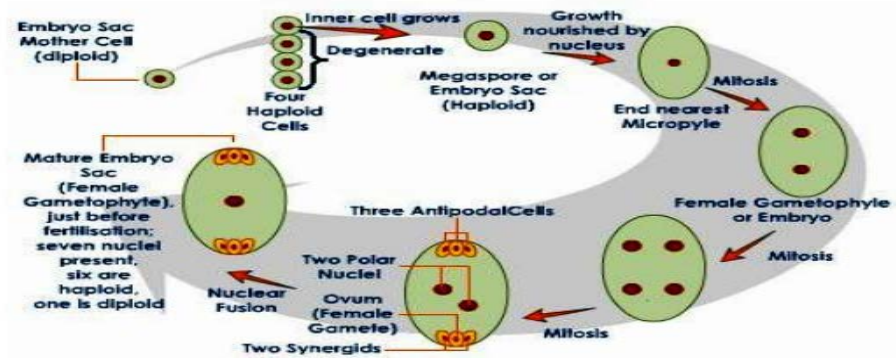


Fig. Types of ovules

DEVELOPMENT OF THE FEMALE GAMETOPHYTE OR EMBRYO SAC----



Types of embryo sac--

1. Monosporic ------Polygonum type
2. Bisporic--------Allium type
3. Tetrasporic-------Peperomea type

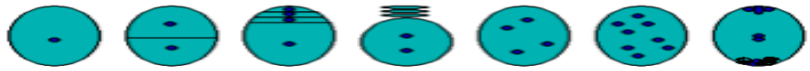


Fig. 6.14: *Polygonum* type embryo sac

Fig. 6.16: *Allium* type

Fig. 6.18: *Peperomia* type

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	FERTILIZATION
Hours Required	
Learning Objectives	To understand-What is fertilization? • About the different ways of entry of pollen tube into the ovule. • What is syngamy? • What do you understand by triple fusion? • understand about double fertilization
Previous Knowledge to be reminded	Flower structure ,Male and female gamets
Examples/Illustrations	Different types of flowers
Additional Inputs	Flash cards
Teaching Aids Used	B.B & PPT
References Cited	Pandey, A. K. (2000) Introduction to Embryology of Angiosperms.
Student Activity Planned after teaching	Assignment
Activities planned outside the class	Collection of flowers
Any other activity	
Synopsis	

FERTILIZATION----

In Angiosperms, the fertilization is being completed as follows:

Entry of pollen tube into ovule---

After arriving in the ovary, the pollen tube finds its way into the ovule. The pollen tube may enter into the ovule via three routes.

1. Through the micropyle 2. Through the chalazal end 3. Through the integument

Entry of pollen tube into the embryo sac. It may be: (i) between the egg cell and one of the synergids e.g. Fagopyrum

(ii) between the wall of the embryo sac and one or other synergids.er. Cardiospermum

(iii) directly penetrates one of the synergids e.g. Oxalis

Discharge of male gametes from pollen tube----

Syngamy-

fusion of gametes As the one of the male gametes reached the egg, it fuses with it. As a result of this fusion diploid zygote/oospore (2n) forms (because you know the egg and the male gamete, both are haploid). The fusion of male and female gametes is known as fertilization. This is also known as syngamy

Triple fusion—

The other male gamete fuses with the two polar nuclei (or secondary nucleus, if the two have already fused) and so forms triple fusion nucleus (3n), called primary endosperm nucleus

Double fertilization ---

Thus in an embryo sac two sexual fusions occur; one is syngamy (i.e. fusion of one male gamete with the egg) and another is triple fusion (i.e. fusion of other male gamete with the polar nuclei or

secondary nucleus), and therefore, the phenomenon is known as double fertilization .

As a result of first fertilization the zygote or oospore cell is formed which is the mother cell of the embryo and is a diploid cell containing 2n complement of the chromosomes. The nucleus of the triple fusion product (primary endosperm nucleus) is triploid or 3n. This is the first nucleus of the endosperm.

Double fertilization is a very unique phenomenon in Angiosperms and discovered for the first time by S.G. Nawaschin (1898) in Lilium and Fritillaria species as described above.

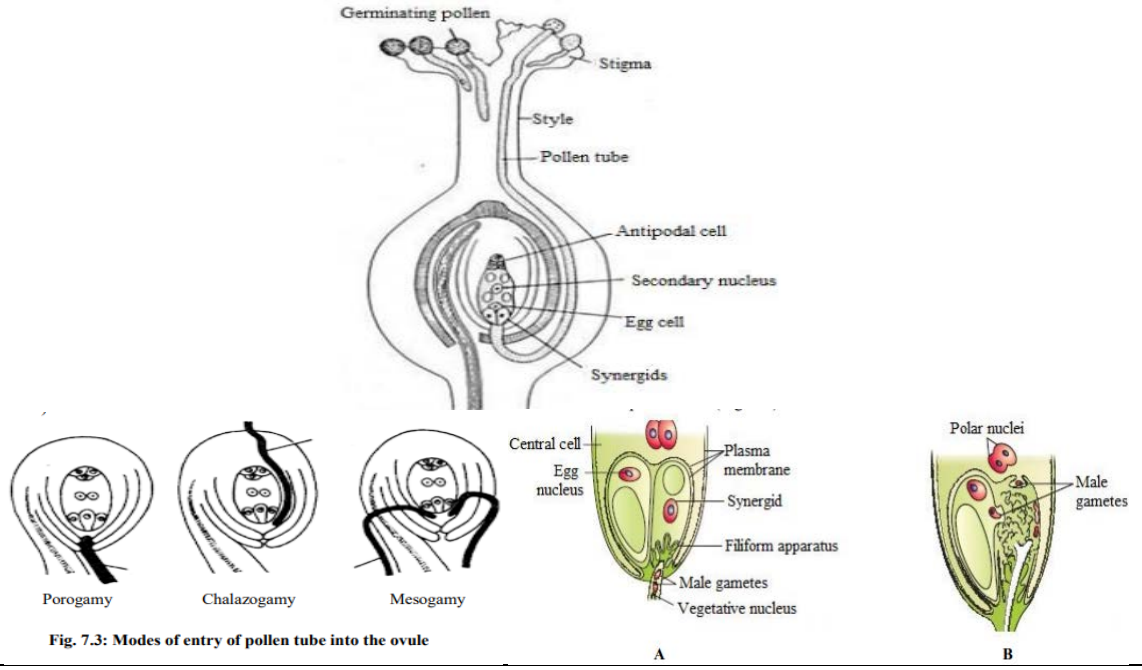

Fig. 7.3: Modes of entry of pollen tube into the ovule

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	III
Name of the Topic	Endosperm
Hours Required	2
Learning Objectives	To understand--What is endosperm? How it forms and on what basis endosperm categorized into different types?
Previous Knowledge to be reminded	Flower structure
Examples/Illustrations	Different types of sedds
Additional Inputs	Charts
Teaching Aids Used	B.B&PPT
References Cited	Pandey, A. K. (2000) Introduction to Embryology of Angiosperms.
Student Activity Planned after teaching	Group Discussion
Activities planned outside the class	Diagrams practice
Any other activity	Seeds Collection
Synopsis	

Endosperm----

Development of the Endosperm—

Depending upon mode of development three types of endosperm has been recognized:

1. Nuclear endosperm 2. Cellular endosperm 3. Helobialendosp

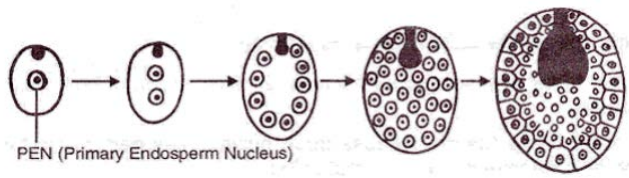

Fig.7.7: Nuclear endosperm formation

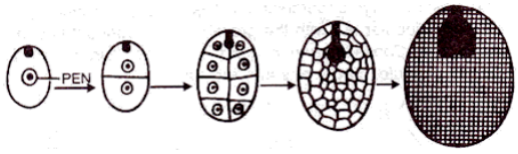

Fig.7.8: Cellular endosperm formation

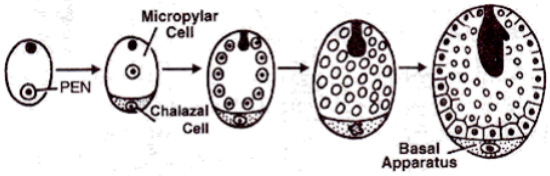

Fig.7.9: Helobial endosperm formation

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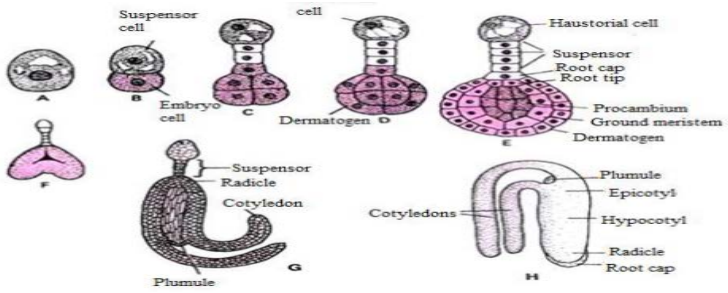
Name of the Department/Subject	**BOTANY**
Name of the Lecturer	**K.Ravichandra Reddy**
Course/Group	**II BZC**
Paper	**III**
Name of the Topic	**Development of the embryo**
Hours Required	**2**
Learning Objectives	**To understand -Definition of embryo • development of dicotyledonous and monocotyledonous embryo.**
Previous Knowledge to be reminded	**Cell Division**
Examples/Illustrations	**Different types of seeds**
Additional Inputs	**Charts**
Teaching Aids Used	**B.B&PPT**
References Cited	**Pandey, A. K. (2000) Introduction to Embryology of Angiosperms.**
Student Activity Planned after teaching	**Questioneer**
Activities planned outside the class	**Assignment**
Any other activity	
Synopsis	

Development of the embryo-----

Dicotyledonous embryo development—



Development of monocotyledonous embryo---

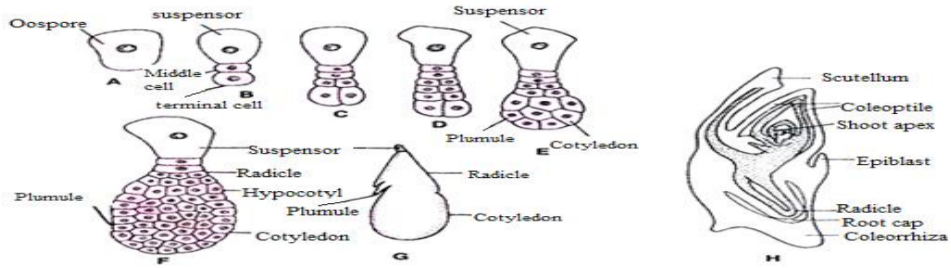


Fig.7.11A-G: Stages in development of a monocot embryo; H.A monocot embryo of a grass

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	Ecology-Climatic Factors-Temparature
Hours Required	2
Learning Objectives	To know the Temperature effects on plants
Previous Knowledge to be reminded	Basics of plant physiology
Examples/Illustrations	Light spectrum
Additional Inputs	Flash card
Teaching Aids Used	B.B & PPT
References Cited	Misra, R. (1968): The Ecology work Book Oxford &Odum E.P. (1971): Fundamentals of Ecology
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Assignment
Any other activity	
Synopsis	

TEMPERATURE

Plants require definite range of temperature to perform physiological activities. Generally temperature range of 26 to 32 C is suitable for many plants. Based on tolerance to heat plants are classified as follows: -

a) Megatherms :- These plants require high range of temperature ie.,40 C . Ex: Xerophytes

. b) Mesotherms: These plants require neither high or low range of temperature ie.,20 C to 40 C .

c) Microtherms:- These plants require very low temperature ie., 0 to 20 C .

d)Hekisthotherms:- These plants require extreme low temp..Ex: Alpine vegetation, bacteria. “Some plants require low temperature for flowering. Cold treatment of plants to induce early flowering is called ‘Thermoperiodism’.It is also called ‘Vernalisation ‘. Lysenko used the term Vernalization”.

Temperature influences most plant processes, including--

- Photosynthesis,
-Transpiration
- Respiration,
- Germination, and
-flowering.

As temperature increases (up to a point), photosynthesis, transpiration, and respiration increase. When combined with day-length, temperature also affects the change from vegetative (leafy) to reproductive (flowering) growth. Depending on the situation and the specific plant, the effect of temperature can either speed up or slow down this transition.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	Ecology-Climatic Factors-Light
Hours Required	2
Learning Objectives	To know the Light effects on plants
Previous Knowledge to be reminded	Basics of plant physiology
Examples/Illustrations	Light spectrum
Additional Inputs	Flash cards
Teaching Aids Used	B.B & PPT
References Cited	Misra, R. (1968): The Ecology work Book Oxford &Odum E.P. (1971): Fundamentals of Ecology
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Assignment
Any other activity	
Synopsis	

LIGHT :

Based on quantity& intensity of light requirement ,plants are ecologically classified into 2 types.

I) Heliophytes: Plants growing best in full sun light.

II) II) Sciophytes: Plants growing best in low light intensity. Length of the daily light period to which plants are exposed has effect on the vegetative growth as well as flowering of the plants. The influence of light on the flowering process in plants is called 'Photoperiodism'.

---Based on their light requirement for flowering, plants are classified into 3 types:-

I] Short day plants:- Plants which flower when day length is short(Between 12- 14 hours) are called' Short day plants'. Ex: - Aster, Dhalia, Tobacco,Chrysanthimum, Datura, Salvia.

2] Long day plants : Plants which flower when day length is length is long are called' Long day p lants'.Ex: Potato, Wheat, Spinach, Radish.

3] Day neutral plants:- Plants in which flowering is not affected by length of the day are called 'Day neutral plants'. Ex: Pea, Tomato, Balsam,Sunflower, Cucumis, maize

Light is an ecological factor that affects the- distribution of plants. Radiant energy released from sun on reaching earth surface constitute light. It is essential for

----Development of Chlorophyll,
---Photosynthesis,
---Opening and closing of stomata,
----Growth,
------Flowering etc

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	Ecology-Edaphic Factor
Hours Required	2
Learning Objectives	To know the soil effects on plants
Previous Knowledge to be reminded	Basics of plant physiology
Examples/Illustrations	Different types of soils
Additional Inputs	Flash cards
Teaching Aids Used	B.B & PPT
References Cited	Misra, R. (1968): The Ecology work Book Oxford &Odum E.P. (1971): Fundamentals of Ecology
Student Activity Planned after teaching	Assignment
Activities planned outside the class	Collection of different types of soils
Any other activity	
Synopsis	

Part of earth's crust that supports living organisms, particularly plants is called 'Soil'. It is formed by weathering of rock. It is composed of Mineral matter, Soil water, Soil air, Soil organisms, Horizons etc.

1**.MINERAL MATTER**

weathering of rock results in mineral particles , which varies in size . depending on their size , mineral particles are of following types:

NAME OF PARTICLE	**DIAMETER (mm)**
Clay	Less than 0.002
Silt	0.002 to 0.020
Fine sand	0.020 to 0.200
Coarse sand	0.200 to 2.000
Fine gravel	2.000 to 5.000
Coarse gravel	Above 5000

Soil texture is determined by relative proportion of mineral particles of different sizes present in the soil. Based on this soil is classified into following types:-

a) Sandy soil b) Loam soil. c)Clay soil d) Silt soil

ORGANIC MATTER [SOIL HUMUS]

1) Mull humus 2) Mor humus

SOIL SOLUTION

Based on the PH value of soil solution soil can be grouped into 3 types:-

a) ***Acidic soil***b)***Alkaline soil*** c) ***Neutral soil***

SOIL AIR

Spaces between soil particles are known as Pore spaces. These are occupied by soil solution and gases. Space between the soil particles consists of air .it constitutes soil air. gases present are similar to those present in the atmosphere.

SOIL MOISTURE [SOIL WATER]

1.Hygroscopic water 2) Capillary water 3) Gravitational water

Holard- Chresard- Echard.

Based on water content of the soil, ecologically plants are classified into 3 types. They are :-

a) Hydrophytes b) Xerophytes C) Mesophytes

SOIL ORGANISMS

SOIL PROFILE

1) 'A' Horizon:.
   - A00 region
   - A0 region
   - A1 layer
   - A2 Layer

2)'B' Horizon.

3) 'C' Horizon

4) 'D' Horizon

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	Ecology-Biotic factor
Hours Required	2
Learning Objectives	To know the Biotic factors effects on plants
Previous Knowledge to be reminded	Basics of Pollination,Lianes,Seed dispersal
Examples/Illustrations	Different types of
Additional Inputs	chart
Teaching Aids Used	B.B & PPT
References Cited	Misra, R. (1968): The Ecology work Book Oxford &Odum E.P. (1971): Fundamentals of Ecology
Student Activity Planned after teaching	Assignment
Activities planned outside the class	Collection of different types of soils
Any other activity	Collection of paper cuttings
Synopsis	

Individuals in a population interact which may be beneficial to both interacting organisms or beneficial to only one partner and harmful to one or both the interacting organisms.

Beneficial interactions are called 'Positive 'and harmful interactions are called 'negative 'interactions'.

A]POSITIVE INTERACTIONS

These include---

1)Mutualism-----Ex: Lichens,Nitrogen fixers,Mycorrhizae,Dispersal of fruits and seeds Pollination, Myrmecophily

2) Commensalism----Ex: Lianas, Epiphytes,

NEGETIVE INTERACTIONS

These include---

1)Antibiosis- .Antibiosis is a type of negative interaction where one interacting organism is benefited & the other is neither benefited nor harmed. Ex: a) Many members of Actinomycetes fungi, number of lichens produce substances inhabits molds and bacteria. b) Algae Chlorella vulgaris in cultures inhibits growth of Diatom. c) Blue green algae Mycrocystis produce toxins hydroxyl amine which causes death of microbes.

2) Competition--Competition is a type of Negative interaction where both the interacting organisms are harmed. Ex: a)In ecosystem individuals of the same species or different species compete for space, light, food etc. for their survival. b)In soil Fung, high degree of competition saprophytic ability is shown.

3)Parasitism-- a)Cuscuta is a total parasite on green plants. It sucks food, water from host plants through haustoria. b) Some Bacteria live parasites in plants, animals and human beings. Ex; Citrus canker, Mango leaf spot. They cause diseases to the host. C)Fungi such as Albugo, Puccinia, and Cercosporaetc.live as parasites on economically important crops, causing diseases.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	Ecosystem--Components
Hours Required	3
Learning Objectives	To know the Interaction between biotic and abiotic components
Previous Knowledge to be reminded	Living things and non living things
Examples/Illustrations	Different types of plants and animals
Additional Inputs	Chart
Teaching Aids Used	B.B & PPT
References Cited	Misra, R. (1968): The Ecology work Book Oxford&Odum E.P. (1971): Fundamentals of Ecology
Student Activity Planned after teaching	Group discussion
Activities planned outside the class	Chart preparation
Any other activity	Collection of different organisms
Synopsis	

ECOSYSTEM:

Introduction A Biotic community lives in an environment which provides materials , energy requirements and forms an interacting system called " Ecosystem". The term Ecosystem was introduced by A.G. Tansley in 1935. An Ecosystem can be defined as "A Structural and Functional unit of Biosphere consisting of living organisms and their environment both interacting and exchanging materials between them".

STRUCTURAL COMPONENTS OF AN ECOSYSTEM -----An Ecosystem consists of 2 components. They are: -I] A Biotic component II] Biotic component.

I] **A Biotic components** :- The Non living elements of an Environment constitute Abiotic component.They are as follows:- a) Climatic factors b)Inorganic factors c) Organic substance

II] Biotic components:- The living organisms like Plants, Animals, Micro organisms of an environment constitutes Biotic components. These are classified into 3 groups Such as Producers, consumers, Decomposers.

1] PRODUCERS: - Producers are Autotrophs .Ex: Green plants. Chlorophyll present in green plants converts solar energy into chemical energy to prepare organic food using carbon dioxide and water during photosynthesis.

2] CONSUMERS:-Consumers are 'Heterotrophs'. I.e., these depend on producers for their food. These are of 3 types. They are Primary, Secondary, tertiary. A) Primary consumers B) Secondary consumers C) Tertiary consumers

3]DECOMPOSERS: Decomposers are Saprophytes ,They obtain their food by decomposing dead bodies of producers, consumers. These occupy fifth trophic level [T] & often called' Micro consumers' as they are microscopic OR Reducers as they decompose and remove dead bodies. Ex:- Saprophytic Bactria, Fungi.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	Food Chain & Food Web
Hours Required	2
Learning Objectives	To know the Food habits of different animals
Previous Knowledge to be reminded	Autotrophs and Heterotrophs
Examples/Illustrations	Different types of Animals
Additional Inputs	Chart
Teaching Aids Used	B.B & PPT
References Cited	Misra, R. (1968): The Ecology work Book Oxford&Odum E.P. (1971): Fundamentals of Ecology
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

FOOD CHAIN--- Flow of food energy from producers through series of organisms with repeated eating and being eaten by others is called 'Food chain'.

I). Grazing food chain: - (predators food chain) In Grazing food chain there is flow of Energy in the form of food from green plants to primary, secondary and tertiary consumer.

Ex:-1] Food chain in Grassland Ecosystem

Producer-◊Primary consumer-◊Secondary consumer--◊ Tertiary consumer◊Quaternary con

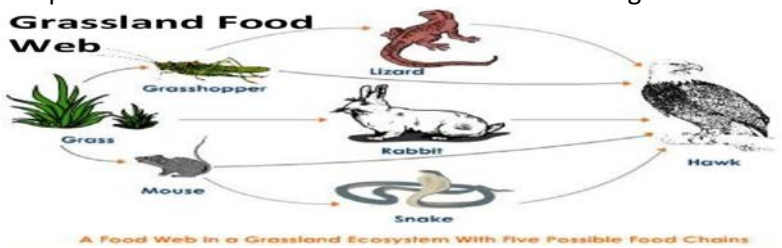
Grass-----◊Grasshopper--------◊Frog----------◊Snake----------◊Howk

2. Food chain in Forest Ecosystem:- Higher plants---◊Deer, Elephant------◊Lion, Tiger

3. Food chain in Aquatic Ecosystem:-Phytoplanktons--◊Zooplanktons--◊Small fish---◊Large fish

II) Detritus food chain: - In Detritus food chain there is flow of Food Energy from plants to Detritus made up of dead organic matter to micro organisms, then to Detrivores(crabs) and their predators(fishes) Ex:- Mangroove leaves----◊ Detritus----◊ Microorganisms---◊Crabs-------◊Fishes

FOOD WEB--Net work of food chains which are interconnected at different trophic levels to form complex web is called "Food web". OR An interlocking of food chain is called as 'Food web'.



A Food Web in a Grassland Ecosystem With Five Possible Food Chains

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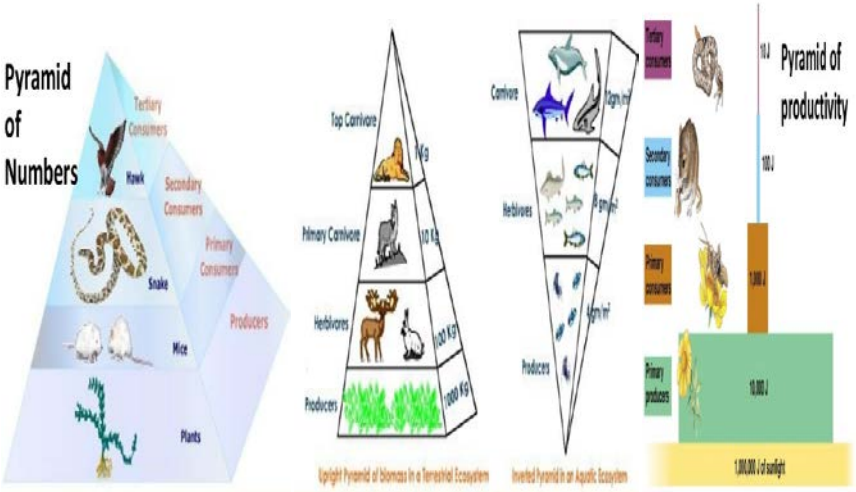
Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	Ecological Pyramids
Hours Required	2
Learning Objectives	To know the relation ship between different animals
Previous Knowledge to be reminded	Autotrophs & Heterotrophs
Examples/Illustrations	Different types of living things
Additional Inputs	Charts
Teaching Aids Used	B.B& PPT
References Cited	Misra, R. (1968): The Ecology work Book Oxford
Student Activity Planned after teaching	Assignment
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

ECOLOGICAL PYRAMID -The graphic representation of the structure and functions of various trophic levels of organisms is called “Ecological pyramid”. producers forms the base , while successive trophic levels forms the steps one above the other and top carnivores form tip of the pyramid. It was devised by British ecologist charls Elton.

TYPES OF ECOLOGICAL PYRAMID Ecological pyramid is of 3 types .they are 1) Pyramid of Number, 2) pyramid of Biomass, 3) Pyramid of energy.



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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	population
Hours Required	2
Learning Objectives	To know the population increase and decrease in ecosystem
Previous Knowledge to be reminded	
Examples/Illustrations	Different animals and plants
Additional Inputs	
Teaching Aids Used	B.B&PPT
References Cited	Misra, R. (1968): The Ecology work Book Oxford &Odum E.P. (1971): Fundamentals of Ecology
Student Activity Planned after teaching	assignment
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

POPULATION --- 'Population' is defined as a group of freely interbreeding individuals of the same species present in a specific area at a given time. For example, when we say that the population of a city is 50,000, we mean that there are 50,000 humans in that city. However, all populations of humans living in any part of the world constitute the species Homo sapiens. A population has traits of its own which are different from those of the individuals forming the population. An individual is born and dies but a population continues. It may change in size depending on birth and death rates of the population. An individual is either female or male, young or old but a population has a sex ratio and age structure, which means, the ratio of male to female in the population and the various age groups into which the population may be divided. The characteristics of any population depends on:

i)density of the population,
(ii) natality (birth rate),
(iii) mortality (death rate),
(iv) dispersal,
(v) biotic potential
(vi) age distribution
(vii) dispersion and
(viii) growth form

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	Community characters
Hours Required	6
Learning Objectives	To know the different communities
Previous Knowledge to be reminded	Hydrophytes, mesophytes and xerophytes
Examples/Illustrations	Different types of aquatic plants and xerophytes
Additional Inputs	
Teaching Aids Used	B.B&PPT
References Cited	Misra, R. (1968): The Ecology work Book Oxford &Odum E.P. (1971): Fundamentals of Ecology
Student Activity Planned after teaching	questioneer
Activities planned outside the class	Chart preparation
Any other activity	
Synopsis	

Analytical Characters

Analytical characters are further characterized as quantitative and qualitative. Qualitative characters are difficult to measure whereas quantitative characters can be measured easily. Qualitative characters

These mainly include composition, physiognomy, phenology, stratification, abundance, sociability, vitality and vigor, life form (growth form), etc.

Floristic composition--This refers to the type of species occurring within a community. In every community some species are abundantly present and are referred as dominant species.

Stratification of vegetation--It is another very important feature of a vertical strata in a community. The growth form of the plant determines the vertical structure which includes their size, branching and leaves. The vertical structure is greatly influenced by physical features such as light

Periodicity (phenology, aspection)

It refers to the changes in characteristics of community with seasonal changes. Each species has a different requirement for light, temperature, moisture and other environmental factors. Accordingly, the period of growth events such seed germination, vegetative development, flowering and fruiting (reproductive phase), fruit and seed dispersal and seed dissemination varies for each species.

Daubenmire classified according to vitality into different groups:

V1-plants whose seedlings die

V2-seedlings grow but unable to reproduce

V3-reproduce vegetatively
V4-reproduce sexually but are uncommon
V5 reproduce sexually and grow regularly

Life forms :

Raunkier (1903) gave a system in which plants were classified according to the relation of their height above ground to the pernnating organ.

i)Phanerophytes
ii) Chamaephytes
iii) Hemi cryptophytes
iv)Cryptophytes
v)Therophytes

SociabilityThe plants have been categorized into five groups depending upon their sociability.

S1- Plant found separately from each other i.e. grow singly
S2- Group of 4-6 plants growing at a place.
S3- Small group of plants growing at a place.
S4- Big group of plants growing at a place.
S5- A large number of plants occupying an area

Quantitative characters

These include parameters that can be measured or counted.

1**. Population density**---
2. **Cover (herbage cover**)--
3.**Plant height**--
4. **Weight of plants (biomass)**

Synthetic Characters

Presence and Constance:

Fidelity:

Dominance:

Relative frequency and Relative dominance (cover basis) are obtained as follows:

Relative density = Density of the species x 100/Total density of all the species

Relative Frequency = Frequency of the species x 100/Total frequency of all the species

Relative dominance (cover) = Dominance (cover) of the species x 100/Total dominance (cover) of all the species

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	Levels of biodiversity
Hours Required	2
Learning Objectives	To understand about Biodiversity and levels
Previous Knowledge to be reminded	Chromosome DNA and gene structure
Examples/Illustrations	Different types of ecosystems
Additional Inputs	
Teaching Aids Used	B.B&PPT
References Cited	Kumar, H.D. (1992): Modern Concepts of Ecology
Student Activity Planned after teaching	Questioner
Activities planned outside the class	Assignment
Any other activity	
Synopsis	

Levels of biodiversity –

Biodiversity is commonly considered at three different levels:

1. Within species (intraspecific) diversity; usually measured in terms of genetic differences between individuals or populations.
2. Species (interspecific) diversity, measured as a combination of number and evenness of abundance of species.
3. Community or ecosystem diversity, measured as the number of different species assemblages.

Biodiversity, therefore, is usually considered at three hierarchical levels i.e. Genetic, Species and Community and Ecosystem levels.

1. Genetic diversity--Genetic diversity refers to any variation in the nucleotides, genes, chromosomes, or whole genomes of organisms. This is the "fundamental currency of diversity" (Williams and Humphries, 1996) and the basis for all other organismal diversity.

2.Species diversity: • A group of organisms genetically so similar, that they can interbreed and fertile offsprings is called a species.

• The species diversity is usually measured in terms of the total number of species within discrete geographical boundaries. Species diversity - "species are groups of actually or potentially interbreeding natural populations that are reproductively isolated from other such groups" (Mayr 1963)

3.Community-level diversity: It is defined by the species that occupy a particular locality and the interactions between them. It represents the collective response of species to different environmental conditions.

Alpha, Beta, and Gamma Diversity Whittaker (1972) described three terms for measuring biodiversity over spatial scales: alpha, beta, and gamma diversity.

- **Alpha Diversity**.
- **Beta diversity**
- **Gamma diversity**:

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	VALUES OF BIOLOGICAL DIVERSITY
Hours Required	3
Learning Objectives	To understand about uses of plant
Previous Knowledge to be reminded	Plant parts and their uses
Examples/Illustrations	Different types of useful plants
Additional Inputs	
Teaching Aids Used	B.B&PPT
References Cited	Kumar, H.D. (1992): Modern Concepts of Ecology
Student Activity Planned after teaching	Quistioner
Activities planned outside the class	Assignment
Any other activity	
Synopsis	

THE VALUES OF BIOLOGICAL DIVERSITY --

• Human society depend on biological diversity for almost all the food supply, half of its medicines, much of its clothing and in some region virtually all of its fuel and building material and as well as, of course, an important part of its mental and spiritual welfare.

• Ecological services

Biological diversity as a resource The three main approaches used for determining the value of biological resources.

• **Consumptive use value**

• **Productive use value**

• **Non-consumptive use value**:

Benefits of biodiversity

• Economical benefits –

a) Food value –

b) Commercial value –

c) Medicinal value

Aesthetic value –-

• **Ecological benefits/services (Indirect use value)**

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	THREATS TO BIODIVERSITY
Hours Required	2
Learning Objectives	To understand about harmful effects on plants
Previous Knowledge to be reminded	
Examples/Illustrations	Different types of activities which are harmful to plants
Additional Inputs	charts
Teaching Aids Used	B.B&PPT
References Cited	Kumar, H.D. (1992): Modern Concepts of Ecology
Student Activity Planned after teaching	Group discussion
Activities planned outside the class	Assignment
Any other activity	
Synopsis	

THREATS TO BIODIVERSITY ¬ Growing human population - specific types of human actions that threatened biodiversity and ecosystems and causes to extinction of many species are:

≡ Over-hunting/over-exploitation

≡ Habitat loss/ degradation/fragmentation

≡ Deforestation ≡ Invasion of non-native species

≡ Pollution

≡ Climate change

≡ Cultural impacts

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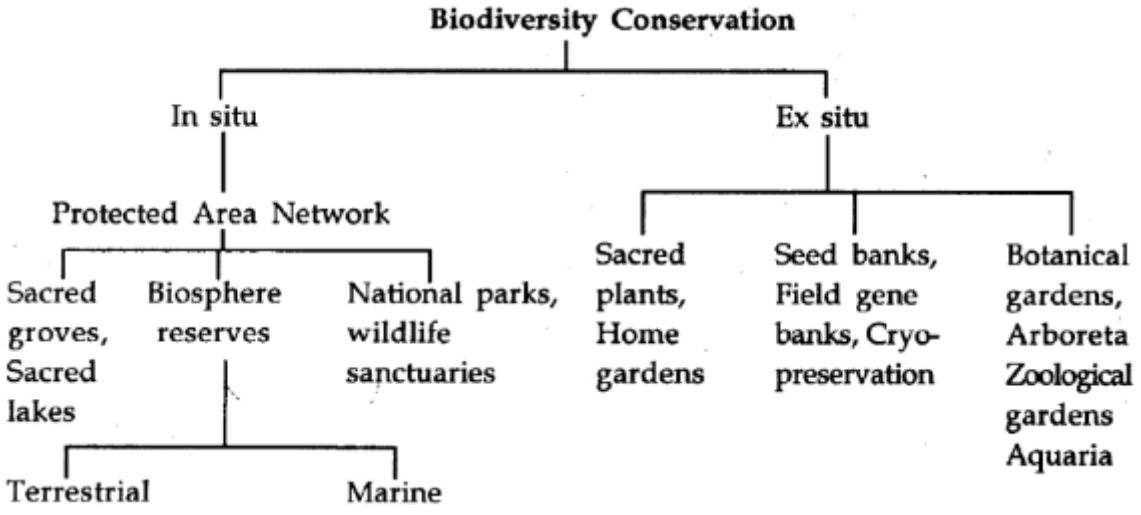
Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	III BZC
Paper	VI
Name of the Topic	BIODIVERSITY CONSERVATION
Hours Required	2
Learning Objectives	To understand about protection methods of plants
Previous Knowledge to be reminded	Uses of plants
Examples/Illustrations	Different types of parks ,sancturies
Additional Inputs	
Teaching Aids Used	B.B&PPT
References Cited	Kumar, H.D. (1992): Modern Concepts of Ecology
Student Activity Planned after teaching	Quistioner
Activities planned outside the class	Assignment
Any other activity	
Synopsis	

BIODIVERSITY CONSERVATION—

Insitu conservation-- In India, ecologically unique and biodiversity-rich regions are legally protected as biosphere reserves, national parks and sanctuaries. India has also a history of religious and cultural traditions that emphasized protection of nature eg. Sacred groves.

Exsitu Conservation---In this approach, threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care and protective maintenance. Examples; zoological parks and botanical gardens, in vitro fertilisation, tissue culture propagation and cryopreservation of gametes



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DEPARTMENT OF BOTANY

TEACHING NOTES (2022-23)

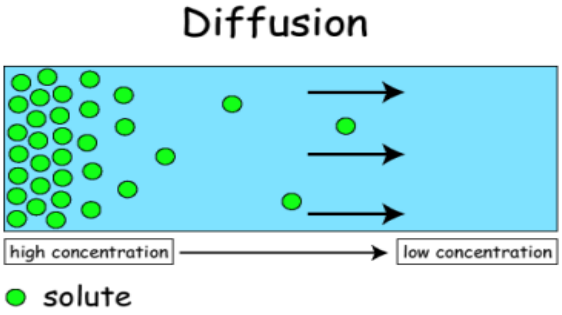
Paper-IV :***Plant Physiology and Metabolism***

Name of the Department/Subject	**BOTANY**
Name of the Lecturer	**K.Ravichandra Reddy**
Course/Group	**II BZC**
Paper	**IV**
Name of the Topic	**Plant-Water relations**
Hours Required	**5**
Learning Objectives	**students will be able: To study the plant water relations and physical properties of water. • To study physical processes of water, diffusion, osmosis, absorption of water and factors affecting water absorption process. • To study the ascent of sap and its mechanism.**
Previous Knowledge to be reminded	**Source of water and Importance of water**
Examples/Illustrations	**Scent bottle**
Additional Inputs	
Teaching Aids Used	**B.B & PPT**
References Cited	**Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi**
Student Activity Planned after teaching	**Questioneer**
Activities planned outside the class	**Assignment**
Any other activity	
Synopsis	

* Water is an important factor for plant growth as it helps to fulfill all the vital activities of plants. Water is essential for photosynthesis, respiration, absorption of minerals and nutrients, metabolism and even to maintain the soil temperature too.
* Beside this, water is also important in various other processes too, as it helps in the germination of seeds and in the process of transpiration etc.
*Water helps a plant by transporting nutrients through the roots. Nutrients are drawn from the soil and used by the plant. Without enough water in the cells, the plants droop so water helps a plant stand.
*Water carries the dissolved sugar and other nutrients through the roots. Plants absorb water through their entire surface- roots, stems and leaves. However, the majority of water is absorbed by root hairs. To maintain the level of water inside the plant cells, it is necessary, to loss excess water from plant cells either in the form of evaporation or through transpiration.
*Evaporation of water from leaves is primarily controlled by stomata, sometimes lenticels and pores also helps in this process. This shows that, plants have a strong and significant relationship with water. Plant water relation means plants control the hydration of their cells including the collection of water from the soil, its transport within the plants and its loss by evaporation from the leaves.
*Transpiration also includes a process called guttation, which is the loss of water in liquid form from the uninjured leaf or stem of the plant principally through water stomata known as hydathodes. Studies have revealed that about 10 percent of the moisture found in the atmosphere is releases by plants through transpiration.

Diffusion:

The diffusion means to spread; to flow out, to extend Diffusion can be simply defined as the movement of particles of matter due to their kinetic energy or the net movement from one point to another because of the random kinetic activities of molecules or ions is called diffusion. Diffusion refers to the process by which molecules intermingle as a result of their kinetic energy of random motion. However, the direction of movement of diffused particles is form the region of higher concentration to the region of lower concentration till both the concentrations equalize.



Osmosis:

* A plant cell has a cell membrane and cell wall as its boundary. The cell wall is freely permeable to water hence it is not buried to movement of water. Osmosis is the net movement of solvent molecule through a semipermeable membrane into a region of higher solvent concentration to the region of lower solvent concentration in the direction that tends to equalize the solute concentration on the two sides.

*If two solutions of different concentrations are separated by a semi-permeable membrane which is permeable to a small solvent molecules but not to the larger solute molecules than the solvent will tend to diffuse across the membrane from the less concentrated to more concentrated solution.

*Osmosis is essentially a special type of diffusion of liquids. In simple words, osmosis may be considered as diffusion when two solutions of different concentrations are separated by means of a semi-permeable.

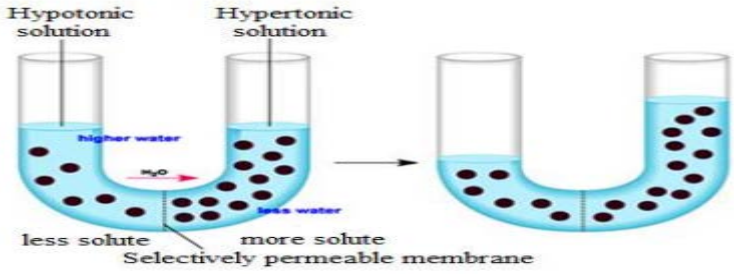


Fig.1.3 Demonstration of Osmosis Phenomenon

Mechanism of Water Absorption:

To know the exact mechanism of water absorption two main theories are proposed by the workers- **(i) Active absorption (ii) Passive absorption**

Active Absorption:

Water absorption takes place due to the activities of root, while shoot does not concern any affair. To explain the mechanism of active absorption various theories have been put forward by scientists/ workers from time to time. There are two major theories to explain the active absorption of water-

(a) Osmotic theory of active absorption and

(b) Non- osmotic theory of active absorption

Ascent of Sap:

As described previously that the absorption of water is takes place by root hairs of the plant from where it reaches to xylem via cortical cells and passage cells. It reaches top to the plant through xylem and then it transpired by leaves and also used for other metabolic activities. From time to time by a number of experiments it has been demonstrated that xylem is the main water conducting tissue. Thus the upward movement of water from stem base to tree top is called ascent of sap.

Mechanism of Ascent of Sap:

I .Vital Force Theories:

All those theories which considered the living cells to be responsible for the upward movement of water and minerals or ascent of sap are categorized under vital theories. Westerrmeir, Godlewski and Jones in 1880-84 stated that the living cells of a stem play a significant role in ascent of sap, according to them the living tissues involved in the ascent of sap.

Godlewski (1884) put forward ‗Clambering' (or relay pumping) theory to explain mechanism of ascent of sap.

Sir J.C. Bose (1923), the Indian scientist proposed ―Pulsation Theory of Ascent of Sap‖ and observed pulsatory activities performed by the innermost cortical cells lying just outside the endodermis.

II. Root Pressure Theory:

It is noted that if a plant stem is cut a few inches above from its base with a sharp knife, the xylem sap is seen flowing out through the cut end. This phenomenon is called ―exudation or bleeding‖ This process of upward flow of water by Priestley. He proposed that this flow is due to a hydrostatic pressure developed in root system. He said that root pressure is assort of hydrostatic pressure which develops in the roots due to accumulation of absorbed water. The term root pressure was postulated by Stephan Hales (1727) and observed that water rise in a 8 mm diameter tube to a height of 63 metres, (in several days) connected to a cut stump of vine system.

III.Physical Force Theory:

1.Capillary Theory: This theory was proposed by Boehm (1805)

2.Imbibitional Theory: Unger (1868)

3.Atmospheric Pressure Theory:

4.Transpiration Pull or Cohesion- tension Theory: This theory was proposed by Dixon and Jolly (1894)

*-Due to transpiration pull the water forms a continuous column from base of the plant to its top and remains under cohesion-tension. Thus the water is pulled up to the top of the tree according to the need of the plant.

*Nature of Cohesion-tension theory: This most accepted and important theory has the following significant features. i) Water forms a continuous column from base of the plant to its top. ii) First of all due to transpiration water is lost from mesophyll cells and develops a pulling force. It puts these cells under tension. iii) This tension may cause a break in the water column but due to cohesive property of water molecules or due to tensile strength of the column the continuity of column is not broken. iv) This tension of transpiration pull is transmitted to the base or root region to regulate absorption.

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Name of the Department/Subject	**BOTANY**
Name of the Lecturer	**K.Ravichandra Reddy**
Course/Group	**II BZC**
Paper	**IV**
Name of the Topic	**TRANSPIRATION**
Hours Required	**3**
Learning Objectives	**students will be able: • To study the phenomenon of transpiration. • To study the mechanism of opening and closing of stomata. • Different factors affecting transpiration**
Previous Knowledge to be reminded	**Source of water and Importance of water**
Examples/Illustrations	**Leaves & Young stems**
Additional Inputs	
Teaching Aids Used	**B.B & PPT**
References Cited	**Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi**
Student Activity Planned after teaching	**Questioneer**
Activities planned outside the class	**Assignment**
Any other activity	
Synopsis	

Plants absorb a considerable amount of water through their roots and carried to the top of the plant. The absorbed water is utilized by the plant. The remaining water is lost from a plant, primarily in the form of water vapours and rarely in the form of liquid from the aerial parts of plant. The loss of water from the living tissue of aerial parts of the plant in the form of water vapours is termed as" transpiration" and in the form of liquid is known as "guttation".

Types of Transpiration:

Lenticular Transpiration:

Cuticular Transpiration:

Stomatal Transpiration:

Mechanism of Stomatal Opening and Closing:

Microscopic direct observation and measurement studies show that the movement and the opening and closing of stomata are brought about by changes in the volume and shape of the guard cells. It is revealed that the expansion and contraction of the guard cells must be due to turgidity and flaccidity respectively i.e. when guard cells are pores are open but when flaccid the pores are closed. The size of the pore depends on upon the degree of turgidity of guard cells. When the guard cells absorb water from the surrounding cells and become turgid. When turgidity increases, the outer thin walls of guard cells stretch outward causing outward stretching of their inner wall. The inner inelastic wall becomes concave and as a result the space surrounding the pore become wide and the pore opens. Thus in the opening and closing of stomata, turgidity of guard cells plays significant role. So what is the mechanism working behind the change in turgidity in guard cells has a question of great controversies. To explain it many theories has been proposed.

1. Theory of Photosynthesis in Guard Cells: According to Von Mohl (1956), stomata open in

day and close at night. Based on this hypothesis he proposed that in the presence of night, photosynthesis occurs in the guard cells and produces carbohydrates due which osmotic pressure of guard cells increases. The opening sequences explains the mechanism of stomatal opening-In presence of light---------- Photosynthesis (in guard cells)--------- Sugar formation takes place- ------Osmotic pressure of cell sap increases--------Resulting Endosmosis (water enters from neighbouring epidermal cells) ------- Turgidity of guard cells increases--------Stomata increases

2. Theory of Starch -----Sugar Inter-conversion: According to LIoyd (1905), Loftfield (1921) and Sayre (1926), the amount of starch in the guard cells increases during night and decreases during day time. Hence the insoluble starch present in the guard cells in hydrolysed into soluble glucose -1- 1P in presence of phosphorylase enzyme during day time and soluble glucose -1-P is converted into soluble starch during night. Thus both these reactions are reversible as follows-
   Starch + Phosphorylase ==========Day/ Night==== Glucose1- PO4 (Insoluble) (Soluble)
3. Theory of Proton Transport-This theory was proposed by Levitt (1974) base on proton - transport concept. It explains the mechanism of opening and closing of stomata.
   * According to this theory, potassium ions (K+) have been found to play a critical role. The opening and closing of the stomata are the result of an active transport of potassium ions into the guard cells and out of them. At first malic acid is formed from starch in the guard cells which dissociates into cations and anions- (R (COOH) 2 ========= R (COO-) 2 + 2H+) H + ========= K+ The organic acid provide H+ in exchange for Potassium (K+) and anions to balance the charges of K+.
   Malic acid is synthesized in illuminated guard cells which accomparises the influx of potassium ions.
   The exact biochemical steps involved are not fully known. One of them possible step many be that during day time starch is metabolized to malic acid and then light triggers the excretion of malic acid from chloroplast into the cytoplasmic guard cells. For stomatal opening and closure Noggle and Fritz (1976) have summarized the events-- i) During day time, light- induced stomatal opening as follows: Light -------Malic acid production ------ Dissociation into hydrogen and malic ions ------ Influx of K+ and efflux of H+ ------- Transport of Potassium malate into the vacuoles -------Osmotic entrance of water into guard cells -------- increase of turgor pressure ---------stomata open.
   Closing to this an abscissic acid (ABA), an inhibitor involves in the closing of stomata, which functions in presence of CO2. ABA inhibits K+ uptake by changing the diffusion and permeability of guard cells. The K+ moves out to the subsidiary cells. ABA results in lowering of PH of guard cells and induces the process of acidification. At low PH starch is synthesized and thus osmotic pressure of guard cells lowers and water moves out of guard cells to subsidiary cells. Due to this the guard cells became flaccid and stomatal pore is then closed.

Plant Anti -respirants:

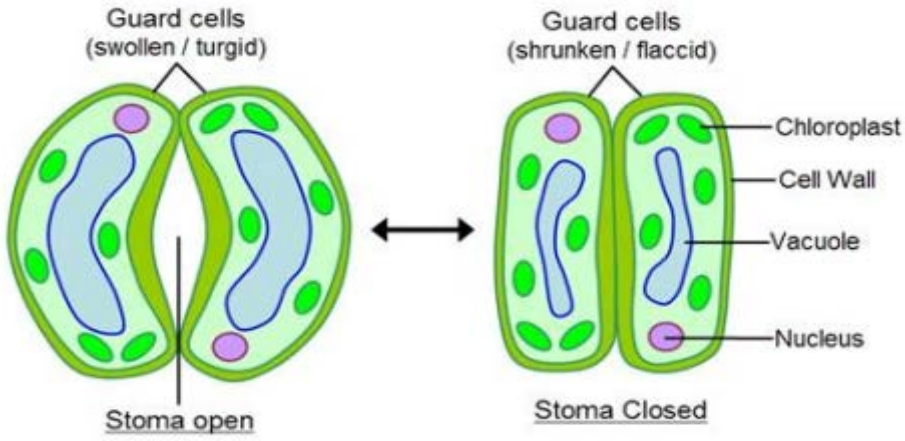
* As a fact the total water absorbed by the plant, almost 98% of the total water is lost in transpiration and only an insignificant amount is utilized by the plat for its own purpose.
*Due to this, plans have to face several problems, this enormous loss of water can be reduce, it will be an asset to nature and to the agriculturists.
* Recently scientists made efforts to find antirespirant substances reducing the transpiration rate without adversely affecting exchange of gases during photosynthesis and plant growth.
*Any material applied to plants for the purpose of retarding transpiration is known as antiaspirant. Examples of antiaspirants are colorless plastics, silicon oils, low viscosity waxes, abscissic acid, CO2 etc.
* Among them colorless plastics, silicon oils and low viscosity waxes, sprayed on the

leaves and these substances forms a thin film permeable to CO_2 and oxygen but not to water. This approach gets only limited success.

* Similarly the fungicide phenyl mercuric acetate when applied in low concentration. it exercised very little toxic effect upon leaves and resulted in partial closure of stomatal pores for over two weeks, it works as antirespirant.

Carbon-dioxide:

Carbon-dioxide is an effective and antiaspirant. It is reported that a little rise in CO_2 concentration from the natural 0.03 to 0.05% in atmosphere includes partial closure of stomata. But its higher concentration is harmful which results in complete closure of stomata and adversely affecting photosynthesis and respiration, while use of CO_2 inhibited phosphorylation. Its usage cannot be economical and is practically feasible in experimental glass houses.



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Name of the Department/Subject	**BOTANY**
Name of the Lecturer	**K.Ravichandra Reddy**
Course/Group	**II BZC**
Paper	**IV**
Name of the Topic	**Mechanism of phloem transport; source-sink relationships.**
Hours Required	**2**
Learning Objectives	**students will be able- • To study structural organization of phloem tissue • To understand significance and mechanism of phloem translocation • To learn about different theories of translocation • Different environmental factors affecting the process of translocation.**
Previous Knowledge to be reminded	**Source of water and Importance of water**
Examples/Illustrations	**Phloem**
Additional Inputs	
Teaching Aids Used	**B.B & PPT**
References Cited	**Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi**
Student Activity Planned after teaching	**Questioneer**
Activities planned outside the class	**Assignment**
Any other activity	
Synopsis	

* The process of translocation of solutes occurs through phloem tissue.

Phloem tissue is made up of different types of cells, each of which performs a specific function in the process of translocation. Translocation of solutes is a pressure driven transport process, solutes are transported from the region where there concentration is high to the regions which require nutrients. Several physiological and environmental factors such as temperature, oxygen, age of plant, seasonal variation, developmental stage of plant, water etc affect the rate of translocation.

Structure of phloem tissue----

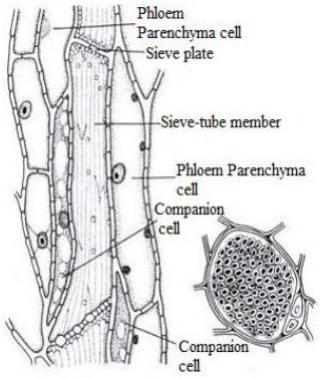

Fig.4.1 Organization of phloem tissue

Evidences which show translocation occurs through phloem—

I.Ringing experiment:

II.Exudation incision in bark:

(iii) Evidences from tracer techniques:

(iv) Chemical analysis:

MECHANISM OF PHLOEM TRANSPORT (PHLOEM LOADING AND UNLOADING)---

Munch mass flow hypothesis:

The hypothesis was proposed by Munch (1927-1930). This hypothesis is also known as pressure flow hypothesis protoplasm of sieve tubes is connected by plasmodesma which forms an uninterrupted permeable system known as symplast. According to this theory solute gets accumulated in leaves as a result of photosynthesis. This increase osmotic potential of leaves due to which water is absorbed from xylem elements and turgor pressure directs transport of solution (containing solute) into sieve tube (phloem).

In other region of plants such as roots and storage organs the solutes are utilized or get converted into insoluble form. This result in lowering of osmotic pressure which lowers turgor pressure overall this results in turgor pressure gradient with high pressure in leaves (source) and lower pressure in roots (sink). Hence water with solutes flows from solute to sink.

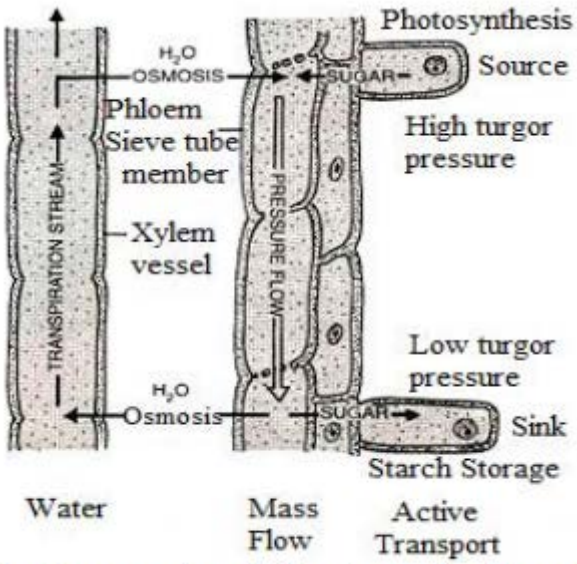

Fig.4.8: Representation of Munch mass flow hypothesis

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Name of the Department/Subject	**BOTANY**
Name of the Lecturer	**K.Ravichandra Reddy**
Course/Group	**II BZC**
Paper	**IV**
Name of the Topic	**Mineral nutrition,**
Hours Required	**3**
Learning Objectives	**student will be able understand- • about the Mineral nutrition • about essential macro-elements, their role, deficiency symptoms, toxicity symptoms • about the essential micro-elements, role, deficiency symptoms, toxicity symptoms • about Absorption of mineral salt • process of Mineral uptake**
Previous Knowledge to be reminded	**Source of water and Importance of water**
Examples/Illustrations	**Inorganic elements**
Additional Inputs	
Teaching Aids Used	**B.B & PPT**
References Cited	**Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi**
Student Activity Planned after teaching	**Questioneer**
Activities planned outside the class	**Assignment**
Any other activity	
Synopsis	

To complete the life cycle normally a living organism requires the supply of a large number of substances from outside. The supply is called nutrition. The autotrophic plants manufacture organic food by the process of photosynthesis. These plants also require some inorganic salts like Potassium, Calcium, Iron, Sulphur etc for their growth. These inorganic substances occur in soil in form of solution. This inorganic nutrition of plants is commonly known as Mineral nutrition.

ESSENTIAL MINERAL ELEMENTS—

The important criteria for essential elements are as follows

1- These elements are absolutely necessary for supporting normal growth and reproduction of plant.
2- 2- These elements are always specific and cannot be replaced by only other elements.
3- 3- These elements is directly involved in the metabolism of the plant.

It has since long been known that carbon, hydrogen and oxygen are essential elements for the plant. In the middle of last century water culture and sand culture experiments has established that the elements nitrogen phosphorus, potassium, magnesium, calcium and iron were indispensable for the plants. In the absence of any one of these elements the growth of shoots or roots are stunted. The essential elements are classified into two broad categories called (i) Macronutrients and (ii) Micronutrients.

The macronutrients are carbon, hydrogen, oxygen nitrogen, phosphorus, sulphur, potassium, calcium, magnesium are generally present in plant tissues in concentrations of 1 to 10mg per gram of dry matter. The micronutrients or trace elements are manganese, copper, molybednum, zinc, boron and chlorine, recently some other such elements have also been discovered, e.g. cobalt, vanadium and nickel. The microelements are required in very low quantity. i.e., about 0.1

mg per gram of dry matter.

MACRONUTRIENTS& MICRONUTRIENTS---

Macronutrients	Functions	Deficiency effects
Carbon (C) , oxygen (O), hydrogen (H)	Basic ingredients for photosynthesis	Inhibition of growth and metabolism, death
Nitrogen (N)	Components of proteins, nucleic acids, coenzymes, and chlorophyll	Inhibition of growth; young leaves are pale green; old leaves are yellow and fall-off easily (chlorosis)
Sulfur (S)	Components of some amino acids	Leaves are pale green or yellowish and growth is slow
Potassium (K)	Activator of enzymes, controlling water diluting balance, and influence osmosis	Slow growth; curling of old leaves' tip, spotted, scorching edge; plant body is weak and easily breaks
Calcium (Ca)	Control some cell functions and strengthen cell wall	Leaves are not formed; terminal bud dies; root growth is inhibited
Phosphor (P)	Components of nucleic acids, phospholipids, and ATP	Vascular bundles are purplish; inhibition of growth; little production of fruits and seeds
Magnesium (Mg)	Components of chlorophyll and activate some enzymes	Chlorosis and falling leaves; disturbed cell division
Chlorine (C)	Control root and stem growth and photolysis	Wilting; chlorosis; and dead leaves
Iron (Fe)	Control protein synthesis and electron transport	Chlorosis; formation of yellow lines and green on grass

TABLE 1.2 (*continue*)

Micronutrients	Functions	Deficiency effects
Boron (B)	Control germination, flowering, fertilization, cell division, and nitrogen metabolism	Shoot growth stops, lateral branches die; leaves thicken and curl and become fragile
Manganese (Mn)	Chlorophyll synthesis and coenzyme activation	Vascular bundles darken and leaves whiten and fall
Zinc (Zn)	Control production of auxin, chloroplast, amylum, and enzymatic components	Chlorosis; leaves are dark red and roots are abnormal
Copper (Cu)	Components of several enzymes	Chlorosis; spots on dead leaves; growth inhibition
Molybdenum (Mo)	Parts of enzymes used in nitrogen metabolism	Pale green and curly leaves

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Name of the Department/Subject	**BOTANY**
Name of the Lecturer	**K.Ravichandra Reddy**
Course/Group	**II BZC**
Paper	**IV**
Name of the Topic	**Enzymes**
Hours Required	**12**
Learning Objectives	**students will be able to - • Explain the enzymes and their role. • Explain about discoveries related to enzymes. • Describe old and new pattern of enzyme nomenclature, and EC Code. • Classify the enzymes on the basis of their catalytic properties. • Describe the characteristic features and properties of the enzymes.**
Previous Knowledge to be reminded	**Proteins and their structures&types**
Examples/Illustrations	
Additional Inputs	
Teaching Aids Used	**B.B & PPT**
References Cited	**Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad: Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi**
Student Activity Planned after teaching	**Questioneer**
Activities planned outside the class	**Assignment**
Any other activity	Chart preparation
Synopsis	

Enzymes are biocatalyst, macromolecules of biological origin, which speeds up a chemical reaction but remain, unchanged itself at the end, so that it can be used again and again. They have extraordinary catalytic power, often far greater than that of synthetic or inorganic catalysts. Some enzymes can make their conversion of substrate to product occur millions of time faster. They have a high degree of specificity for their substrates. They accelerate chemical reactions tremendously and they function in aqueous solutions under very mild conditions of temperature and pH.

DISCOVERY--

*French chemist AnselmePayen was first to discover an enzyme, diastase in 1833.
But biological catalysis was recognized and described in the 1850s by Louis Pasteur. He revealed that the _living intact' yeast cells were responsible for fermentation of sugar in to alcohol and used the term _ferments' for such catalysts.
* 1897 Edward Buchner discovered that yeast extracts could ferment sugar to alcohol, because of this work he is credited for the discovery of enzyme.
* Frederick W. Kuhne coined the word enzymes (en= in, zyme= yeast).
* James B. Summer (1926) isolated enzyme urease for the first time in crystalline form from Jack bean, Canavalia ensiformis at the Cornell University.
* John Northrop crystallized pepsin, trypsin and other digestive enzymes and found them also to be proteins. On the basis of all these findings, he determined the proteinaceous nature of enzymes.

For such a pioneer and innovative work, Sumner and Northrop share the Nobel Prize in 1947. The discovery that enzyme could be crystallized eventually help in the X-ray crystallography of enzyme lysozyme by D.C. Phillips in 1965. J.B.S. Haldane first time suggested that weak bonding interactions between an enzyme and its substrate might be used to catalyze a reaction.

Properties of Enzymes---

1.**Catalytic Property** - Enzymes are capable of catalyzing biochemical reactions. They transform large number of substrate into products without undergoing any change themselves. Catalytic power of enzyme is measured in terms of —turn over number‖. Turn over number is the number of substrate molecules converted into product per unit time, when the enzyme is fully saturated with substrates

2. **Colloidal Nature** - Enzymes are partly or totally proteins hence they are colloidal in nature. They have high molecular weight and low diffusion rate and form colloidal system in water.

3**. Reversibility** - In most of the cases the reactions catalyzed by the enzymes are reversible depending upon the requirements of the cell.

4**. Specificity** - Enzymes are highly specific in action with few exceptions, i.e. particular enzyme can catalyze only a particular type of reaction.

5**. Heat Sensitivity** (Thermostability) - The enzymes are proteinaceous in nature, hence they are thermo labile. They work in narrow range of temperature (20oC – 40oC). Beyond 45oC enzymes get denatured i.e. they looses their activity due to change in 3-D structure of protein and their properties are not restored even after giving suitable temperature.

6. **pH Sensitivity** - Each enzyme acts best at certain pH. Most of the enzymes act in neutral pH. Any increase or decrease in medium pH leads to slow down or inhibition of enzymatic activity.

-Major classes:

1***. Oxidoreductase*** – catalyze oxidation-reduction reaction (transfer of electrons or protons).

2. ***Transferases*** – catalyze reaction which involves transfer of functional groups from one molecule to another molecule.

3. ***Hydrolases*** – catalyze breaking of one molecule in to two molecules by adding water molecule (transfer of functional group to water).

4***. Lyases*** – catalyze reactions in which either a double bond is established due to the removal of a group or a group is added to the double bond.

5***. Isomerases*** – catalyze isomerisation reactions (transfer of functional group within the molecule).

6. ***Ligases*** – also called as synthetases, catalyze those reactions in which linking of two molecules are coupled with the breakdown of pyrophosphate bond of ATP or similar triphosphate.

Mechanism of the enzyme action.

Enzyme-catalyzed reactions are characterized by the formation of a complex between substrate and enzyme (an ES complex). Substrate binding occurs in a pocket on the enzyme called the active site. The function of enzymes and other catalysts is to lower the activation energy, for a reaction and there by enhance the reaction rate. The rate of a reaction is dependent on the activation energy required for the formation of the transition state which further decays into products. Enzymes increase reaction rate by lowering the energy of the transition state, ES complex. For a reaction, a molecule must possess enough energy to collide with sufficient force to overcome their mutual repulsion and to break existing chemical bonds . A reaction without enzyme requires more activation energy than an enzymatic reaction. However, that the overall energy changes from the initial state to the final state is the same with and without the enzyme.

Enzymes speed up the rate of a reaction by lowering the energy barrier between substrates

(reactants) and products but are not themselves used up in the reaction, and are regenerated at end. Thus, a enzyme increases the rate of a reaction but does not affect the equilibrium ratio of reactants and products, because the rate of the reaction in both directions are increased to the same extent.

Mode of Action-----

Lock and Key model:

This model was proposed by a German chemist Emil Fischer in 1898. According to this model, lock is analogous to enzymes and its socket (in which key fits) is analogous to active site, while key is analogous to substrate. It is believed that the enzyme and substrate both have strictly complementary structures which during complex formation fit to each other like a specific key in a particular lock. This model explains enzyme specificity in which a substantially rigid active site is likened to a ‗lock' and the substrate to a ‗key' that fits the lock. The enzyme substrate complex dissociates only after the conversion of substrate into products and the enzyme becomes free and available for further reactions.

Induced Fit model:

This model was proposed by Daniel Koshland in 1966. According to this model, the enzyme and substrate do not have strictly complementary structures but the enzyme has flexible active site structure which is changed according to substrate configuration (Figure – 11.5). This model explains enzyme specificity in which a flexible active site is induced, by a substrate, to change its conformation to an orientation properly fitting the substrate's geometry. Enzyme-substrate complex brings about conformational change in active site, in such a fashion so that catalytic group lies opposite the substrate bonds to be broken. ES binding forces exert strain to form products.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	K.Ravichandra Reddy
Course/Group	II BZC
Paper	IV
Name of the Topic	Respiration
Hours Required	8
Learning Objectives	students will be able to- • Understand the significance and mechanism of respiration. • Learn the mechanism of aerobic and anaerobic respiration. • Understand Kreb's cycle and electron transport mechanism and fermentation mechanism.
Previous Knowledge to be reminded	Stomata lenticels functions and Biomolecules
Examples/Illustrations	Different types of leaves stomata
Additional Inputs	Seeds germination
Teaching Aids Used	B.B & PPT
References Cited	Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
Student Activity Planned after teaching	Questioneer
Activities planned outside the class	Assignment
Any other activity	
Synopsis	

Respiration is one of the many processes needed for survival. It is the process by which energy is released from food by oxidizing the organic molecules. Respiration may occur in the presence of oxygen, in which case it is called aerobic respiration or it may occur in the absence of oxygen and is called anaerobic respiration. The main organic molecules used in respiration are carbohydrates, such as the monosaccharide glucose and fructose, and fats. Proteins may also be oxidized however it is a secondary source as protein is needed for other things such as cell growth and repair.

Respiration starts with glucose (usually). In aerobic and anaerobic respiration initial reactions are common as a result of which pyruvic acid is formed by breakdown of glucose. The process is called Glycolysis or EMP Pathway (Embden-Meyerhof-Parnas Pathway). This process does not require O_2 although this can take place in the presence of oxygen. After this stage, the fate of pyruvic acid is different depending upon the presence or absence of oxygen. (Fig.2). If oxygen is present there is complete oxidation of pyruvic acid into H_2O and CO_2 and chemical reactions through which this occurs is called Tri-Carboxylic Acid cycle (TCA Cycle) or Krebs Cycle. This cycle occurs in mitochondria. If oxygen is absent, pyruvic acid forms ethyl alcohol (C_2H_5OH) and CO_2 without the help of any cell organelle. This process is called anaerobic respiration

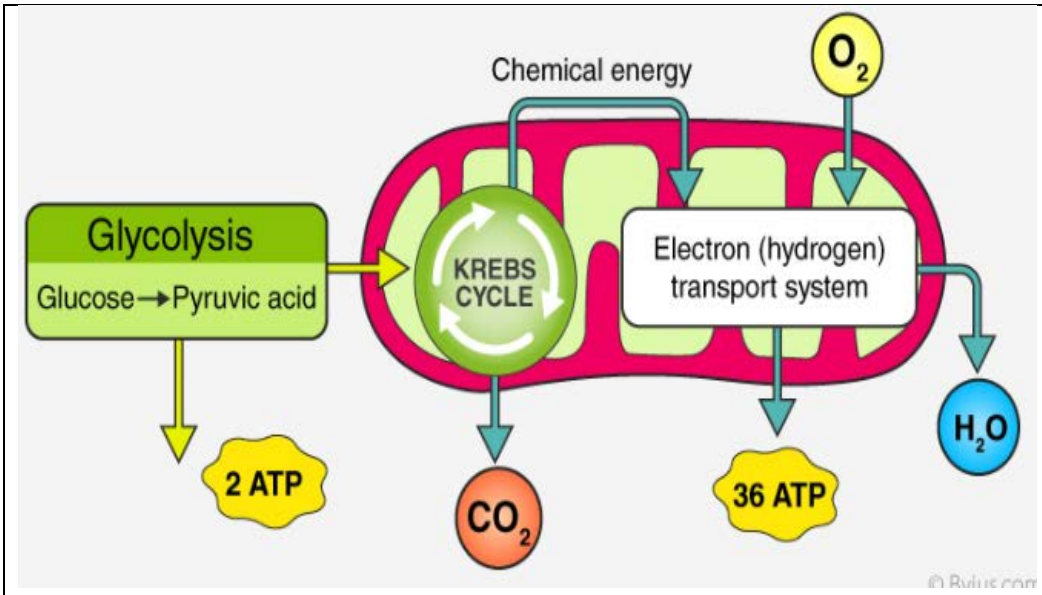
AEROBIC RESPIRATION---

1.Glycolysis

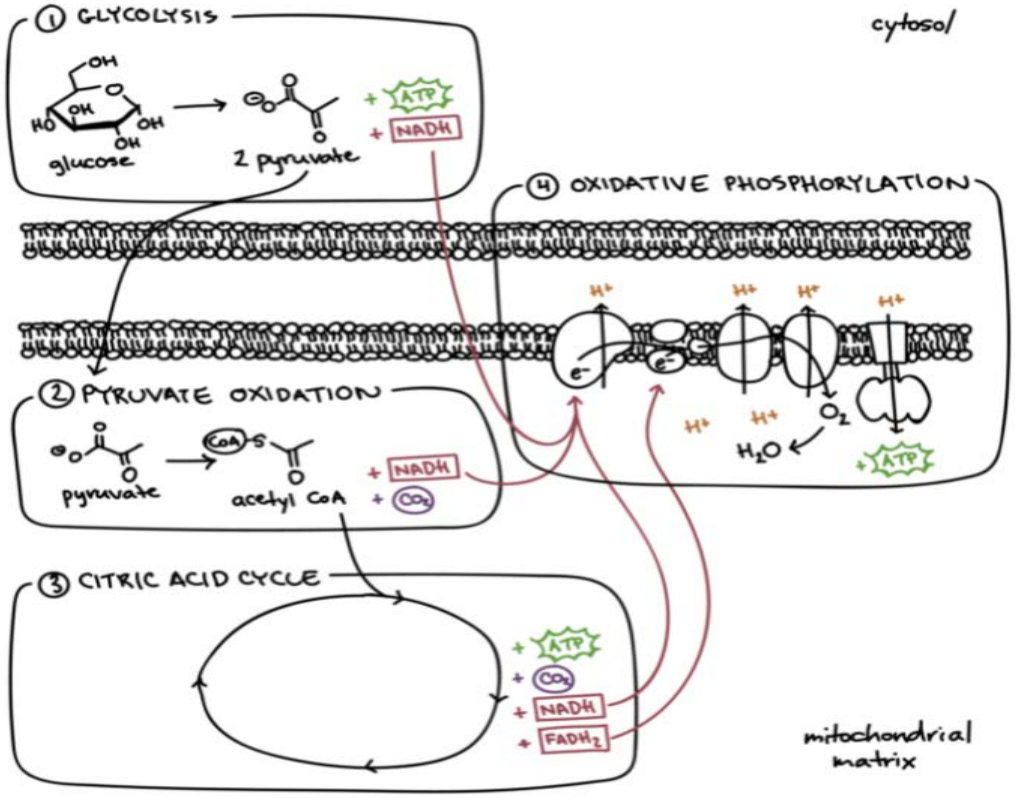
2.Oxidation and decarboxylation of Pyruvate

3.Krebs cycle

4.ETS



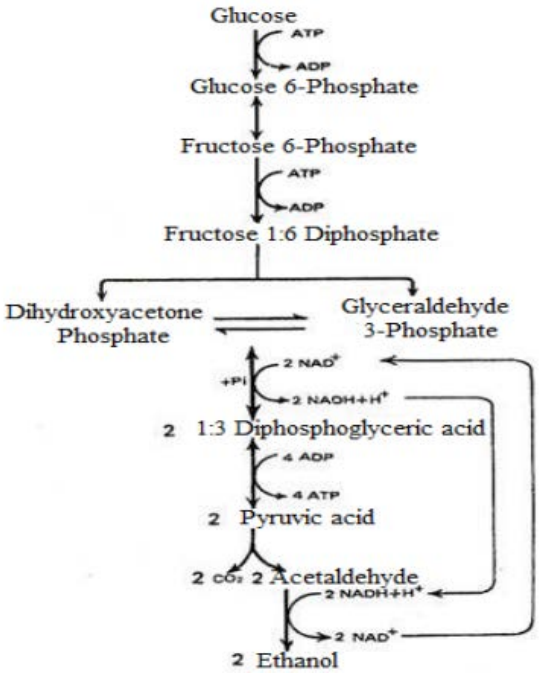
Steps of cellular respiration



ANAEROBIC RESPIRATION—

1.Glycolysis

2.Fermentation



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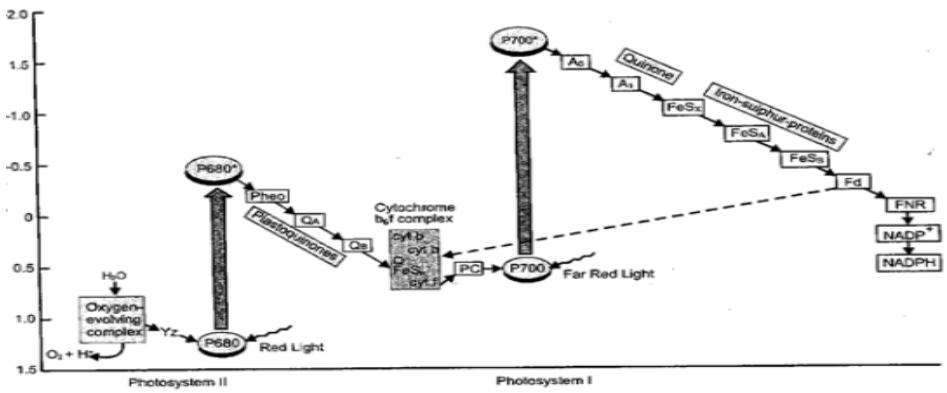
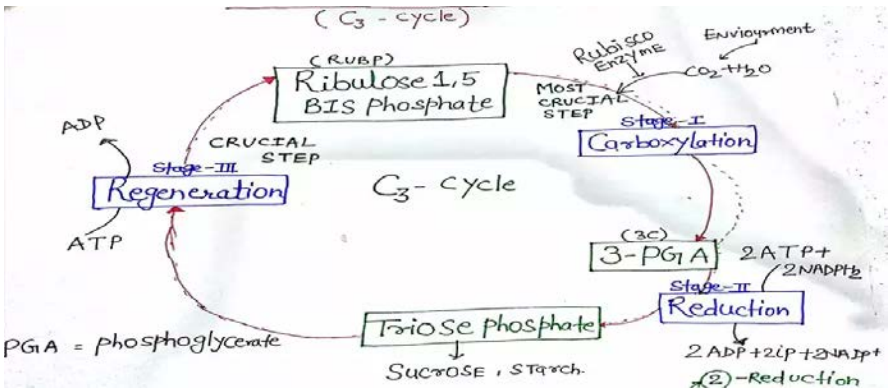
Name of the Department/Subject	**BOTANY**
Name of the Lecturer	**K.Ravichandra Reddy**
Course/Group	**II BZC**
Paper	**IV**
Name of the Topic	**Photosynthesis and Photorespiration**
Hours Required	**12**
Learning Objectives	**students will be able to- • Understand the significance and mechanism of photosynthesis. • Learn about different photosynthetic pigments. • Understand the mechanism of photophosphorylation. • Photorespiration**
Previous Knowledge to be reminded	**Leaf structure and Chloroplast structure**
Examples/Illustrations	**Different types of leaves**
Additional Inputs	**Flash cards**
Teaching Aids Used	**B.B & PPT**
References Cited	**Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi**
Student Activity Planned after teaching	**Questioneer**
Activities planned outside the class	**Assignment**
Any other activity	**Chart preparation**
Synopsis	

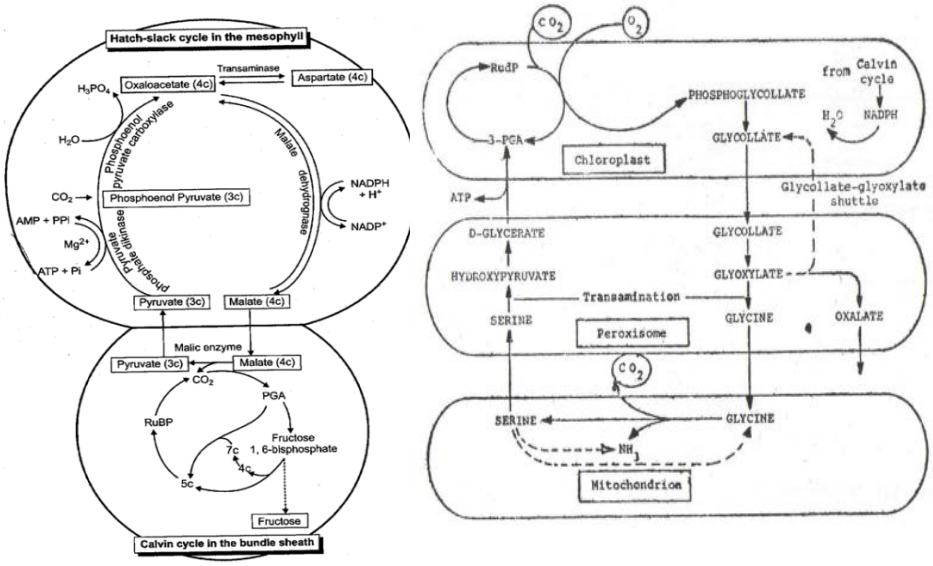
* Photosynthesis is the chemical change which happens in the leaves of green plants. It is the first step towards making food - not just for plants but ultimately every animal on the planet.
*All green parts of a plant have chloroplasts.
* However, the leaves are the major site of photosynthesis for most plants. There are about half a million chloroplasts per square millimeter of leaf surface.
* The color of a leaf comes from chlorophyll, the green pigment in the chloroplasts. Chlorophyll plays an important role in the absorption of light energy during photosynthesis.
* Powered by light, the green parts of plants produce organic compounds and O_2 from CO_2 and H_2O.
*The equation describing the process of photosynthesis is: a. $6CO_2 + 12H_2O$ + light energy $C_6H_{12}O_6 + 6O_2 + 6H_2O$ b. $C_6H_{12}O_6$ is glucose.
*Water appears on both sides of the equation because 12 molecules of water are consumed, and 6 molecules are newly formed during photosynthesis.
*We can simplify the equation by showing only the net consumption of water: a. $6CO_2 + 6H_2O$ + light energy $C_6H_{12}O_6 + 6O_2$
* Photosynthesis is two processes, each with multiple stages.
* The light reactions (photo) convert solar energy to chemical energy.
* The Calvin cycle (synthesis) uses energy from the light reactions to incorporate CO_2 from the atmosphere into sugar.
*In the light reactions, light energy absorbed by chlorophyll in the thylakoids drives the transfer of electrons and hydrogen from water to NADP+ (nicotinamide adenine dinucleotide phosphate), forming NADPH. a. NADPH, an electron acceptor, provides reducing power via energized electrons to the Calvin cycle. b. Water is split in the process, and O_2 is released as a by-product.

* The light reaction also generates ATP using chemiosmosis, in a process called photophosphorylation.
* Thus light energy is initially converted to chemical energy in the form of two compounds: NADPH and ATP.
*The cycle begins with the incorporation of CO_2 into organic molecules, a process known as carbon fixation.
* The fixed carbon is reduced with electrons provided by NADPH.
* ATP from the light reactions also powers parts of the Calvin cycle.
* Thus, it is the Calvin cycle that makes sugar, but only with the help of ATP and NADPH from the light reactions.
* The metabolic steps of the Calvin cycle are sometimes referred to as the light-independent reactions, because none of the steps requires light directly.
* Nevertheless, the Calvin cycle in most plants occurs during daylight, because that is when the light reactions can provide the NADPH and ATP the Calvin cycle requires.
*While the light reactions occur at the thylakoids, the Calvin cycle occurs in the stroma.
* There are two types of photosystems in the thylakoid membrane.
a. Photosystem I (PS I) has a reaction center chlorophyll a that has an absorption peak at 700 nm.
b. Photosystem II (PS II) has a reaction center chlorophyll a that has an absorption peak at 680 nm.
c. The differences between these reaction centers (and their absorption spectra) lie not in the chlorophyll molecules, but in the proteins associated with each reaction center.
d. These two photosystems work together to use light energy to generate ATP and NADPH.
* During the light reactions, there are two possible routes for electron flow: cyclic and noncyclic.
* Noncyclic electron flow, the predominant route, produces both ATP and NADPH.
* Under certain conditions, photoexcited electrons from photosystem I, but not photosystem II, can take an alternative pathway, cyclic electron flow. a. Excited electrons cycle from their reaction center to a primary acceptor, along an electron transport chain, and return to the oxidized P700 chlorophyll. b. As electrons flow along the electron transport chain, they generate ATP by cyclic photophosphorylation. c. There is no production of NADPH and no release of oxygen.
* Certain plant species have evolved alternate modes of carbon fixation to minimize photorespiration.
*C4 plants first fix CO_2 in a four-carbon compound. a. Several thousand plants, including sugarcane and corn, use this pathway.
* A unique leaf anatomy is correlated with the mechanism of C4 photosynthesis.
*In C4 plants, there are two distinct types of photosynthetic cells: bundle-sheath cells and mesophyll cells. a. Bundle-sheath cells are arranged into tightly packed sheaths around the veins of the leaf. b. Mesophyll cells are more loosely arranged cells located between the bundle sheath and the leaf surface.
* C4 photosynthesis minimizes photorespiration and enhances sugar production.
* A second strategy to minimize photorespiration is found in succulent plants, cacti, pineapples, and several other plant families. a. These plants are known as CAM plants for crassulacean acid metabolism. b. They open their stomata during the night and close them during the day. Temperatures are typically lower at night, and humidity is higher. c. During the night, these plants fix CO_2 into a variety of organic acids in mesophyll cells. d. During the day, the light reactions supply ATP and NADPH to the Calvin cycle, and CO_2 is released from the organic acids.
*Both C4 and CAM plants add CO_2 into organic intermediates before it enters the Calvin cycle.



Current concept of the Z-scheme of light phase of photosynthesis. (After Blankenship





C 4 CYCLE **C 2 CYCLE**

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Name of the Department/Subject	**BOTANY**
Name of the Lecturer	**K.Ravichandra Reddy**
Course/Group	**II BZC**
Paper	**IV**
Name of the Topic	**Nitrogen and lipid metabolism**
Hours Required	**12**
Learning Objectives	**students will be able to- Explain and define the nitrogen metabolism, Describe various steps of atmospheric nitrogen fixation, Write an account of nitrogen cycle, Describe the process of Nitrogen assimilation.**
Previous Knowledge to be reminded	**Source of water and Importance of water**
Examples/Illustrations	**Root Nodules**
Additional Inputs	
Teaching Aids Used	**B.B & PPT**
References Cited	**Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi**
Student Activity Planned after teaching	**Questioneer**
Activities planned outside the class	**Assignment**
Any other activity	
Synopsis	

Nitrogen Metabolism--

* Nitrogen is a very important constituent of cellular components.
* N2 plays a significant role in the formation of Alkaloids, amides, amino acids, proteins, DNA, RNA, enzymes, vitamins, hormones and many other cellular compounds which in turn control cellular activities. Without nitrogen, no living organism can survive.
* The nitrogen cycle involves three major steps: nitrogen fixation, nitrification, and denitrification.
* Nitrogen cycle is a cycle within the biosphere including the atmosphere, hydrosphere, and lithosphere.
* Nitrogen is found in several locations, or reservoirs. It is most prevalent in sediments and rocks, second in the atmosphere (78%).
* Nitrogen is considered to be an important for life because it is a major part of amino and nucleic acids. Also, it is well known as important part of Adenosine Tri Phosphate, which is the basic energy molecule for all living things.
* Neither plants nor animals can obtain nitrogen directly from the atmosphere.
* Therefore, they depend on a process which is known as nitrogen fixation.
* Some free living bacteria, fungi and blue green algae (Cyanobacteria) are capable of fixing molecular nitrogen into utilizable form of N2 i.e. NH4. Azatobactorveinlandi, Clostridium pasteurianum, Rhodospirullum rubrum, Chromatium, Nostoc, Anabaena, Rivularia etc are the microbes having the ability to fix the molecular nitrogen (asymbioticNitrigen Fixation).
* Another biological method of nitrogen fixation is known as symbiotic nitrogen fixation.
*Key components in this process are legumes and the symbiotic bacteria which are associated

with the legume's root nodules. These bacteria are known as nitrogen-fixing bacteria.
* Leghemoglobin (also termed as leghaemoglobin or legoglobin), which is a nitrogen or oxygen carrier and hemoprotein found in the nitrogen fixing root nodules of leguminous plants.
* These organisms convert nitrogen in the soil to ammonia, which can then be taken up by plants.
*This process also occurs in aquatic ecosystems, where Cyanobacteria (Blue green algae i.e. Nostoc, Anabaena) participate.
* After nitrogen has been fixed, other bacteria convert it into nitrate, in a process known as nitrification.
* In the first step of this process, Nitrosomonas convert ammonia into nitrite, and in the second step, nitrite is converted into nitrate, by Nitrobacter. This nitrate is then consumed by plants.
* The final step of the nitrogen cycle is called denitrification. This process is performed by a variety of microscopic bacteria, fungi, and other organisms. Nitrates in the soil are broken down by these organisms, and nitrogen is released into the atmosphere. This step completes the cycle.

Lipid Metabolism--

Lipids- The lipids are a large and diverse group of naturally occurring organic compounds.
*They show differential solubility in nonpolar organic solvents (e.g. ether, chloroform, acetone & benzene) and are generally insoluble in water.
* Fatty acids are the hydrocarbon chain with one carboxylic acid (-COOH) group.
*Fatty acids are main components of many lipids, constitutes an even number of carbon atoms (generally 12 to 24).
* Lipids include fats, waxes, sterols, fat-soluble vitamins (such as vitamins A, D, E, and K), monoglycerides, diglycerides, triglycerides, phospholipids, and others. Lipids that contain a functional group ester are hydrolysable in water. These include neutral fats, waxes, phospholipids, and glycolipids.
* Nonhydrolyzable lipids include steroids and fat-soluble vitamins (e.g. A, D, E, and K).
* Fats and oils are made of triacylglycerols or triglycerides which are composed of glycerol (1, 2, 3-trihydroxypropane) and 3 fatty acids to form a triester.
*Complete hydrolysis of triacylglycerols yields three fatty acids and a glycerol molecule.
*The plasma membrane is made up of proteins and lipids.
* The main biological functions of lipids include storing energy, functioning as structural components of cell membranes and acting assignaling molecules.

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Name of the Department/Subject	**BOTANY**
Name of the Lecturer	**K.Ravichandra Reddy**
Course/Group	**II BZC**
Paper	**IV**
Name of the Topic	**Plant growth - development and stress physiology**
Hours Required	**12**
Learning Objectives	**students will be able to- • meaning of growth and development • phases of growth and developmental patterns in plant. • concept of photoperodism• Describe the physiology of flowering, biological clocks and physiology of senescence. • fruit ripening process • seed dormancy and describe various methods to break the dormancy in seeds .**
Previous Knowledge to be reminded	**Cell division**
Examples/Illustrations	**Coconut milk & yeast extract**
Additional Inputs	**Clippings**
Teaching Aids Used	**B.B & PPT**
References Cited	**Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi**
Student Activity Planned after teaching	**Questioneer**
Activities planned outside the class	**Assignment**
Any other activity	
Synopsis	

*Plant growth and development are controlled by several environmental and genetic factors. Growth is any irreversible increase in size of an organism or its parts.

*Development and differentiation involve the progressive specialization of cells into tissues and then plant organs.

* The growth involves an irreversible increase in size which is usually, but not necessarily, accompanied by an increase in dry weight.

* The basic process of growth is to be considered as the production of new protoplasm, which is clearly evident in the regions of active cell division.

* The next stage in growth is increase in plant size, which is the result of absorption of water and the consequent stretching of the tissues, a process which in the strict sense is not growth at all, since it involves little or no increase in the characteristic material of the plant itself.

* The third and the last stage in growth constitute the entry of plenty of building materials, chiefly carbohydrates, into the expanded young tissues. This results in an increase in the dry weight but no visible increase in external size of the plant.

* Growth is, however, more than just an increasing amount of the plant. Differential growth of plant parts results in a characteristic shape. Each plant species has a distinctive form,

development by growth patterns.
*The growth cycle of annual, monocarpic, flowering plants (angiosperms) begins with the fertilized egg, the zygote. The zygote develops into an embryo following cell divisions and differentiation (embryonal stage).
* The embryo is enclosed within a seed where it undergoes a period of inactivity (dormancy). The resting embryo resumes growth during the germination of seed and develops into a seedling (seedling stage).
*The growth is followed by the differentiation. Differentiation can be recognized at cell level, tissue level, organ level, and at the level of an organism.
*It becomes more obvious at the level of organ and organism. For example, if we consider flower as an organ of plant, is bears sepals for photosynthesis and protection of inner floral parts followed by beautiful, coloured petals to attract insects for cross-pollination and stamens for producing male gametes as well as the carpels for bearing the ovules which after fertilization produce seeds.
* Considering a flowering plant as an organism, we observe that its roots are used for absorption of water and minerals and fixation in the soil; the trunk and stem branches bear leaves for photosynthesis, flowers and fruits and the fruits for bearing the seeds which on germination form each a new plant.
* The seedling grows into a vegetative plant (vegetative phase). After some period of vegetative growth, the plant undergoes maturation and enters the reproductive phase.
* Flowering is an example of environmental responses during plant development. Phytochrome, a photo reversible protein pigment, is involved in light-sensing responses in plants and is associated with several responses including flowering, photoperiodism and vernalization.
*As result of flowering fruits are developed and latter containing the seeds. Finally senescence sets in (senescence stage) leading to the death of the plant.

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DEPARTMENT OF **BOTANY**

2022-23

TEACHING NOTES

Paper V-

CELL BIOLOGY, GENETICS AND PLANT BREEDING

Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Cell theory and prokaryotic and eukaryotic cell
Hours Required	2
Learning Objectives	Distinguish prokaryotic and eukaryotic cells
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	Archaebacteria , BGA
Additional Inputs	Animal cell
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany 2. Cell biology by C.B. Power
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Nil
Synopsis	

Cell theory: proposed by schleiden and schwann

1. All organisms are made up of cells
2. All metabolic activities takes place in cells
3. Cells do not form spontaneously.
4. Cells are formed from preexisting cells.

Prokaryotic cell:

1. Well defined nucleus and membrane bound cell organelle absent.
2. Cell wall: made by peptidoglycan and mucoplymers.
3. Cell membrane: mesosomes are respiratory structures and helpin binary fission.
4. 70 s ribosomes are present. Organized into polysomes.
5. Naked DNA is present at nucleoid region.
6. Plasmid is self-replicative additional DNA
7. Flagella do not show 9+2 arrangement.
8. Sex pili help in conjugation.
9. Histones are absent.

Example: Bacteria, Cyanobacteria

Eukaryotic cell:

1. Well defined nucleus and membrane bound cell organelle are present.
2. Cell wall in plant cell made by cellulose and other substances and in fungi it is made by chitin. In animal cell no cell wall is absent.
3. Cell organelle :
    a) Chloroplast: b)Mitochondria
    c) Endoplasmic reticulum: d) Golgi apparatus etc.,

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Ultra structure and functions of cell wall
Hours Required	3
Learning Objectives	Distinguish cell wall of different cells
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	Archaebacteria , BGA
Additional Inputs	Bacterial and fungal cell wall
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany 2. Cell biology by C.B. Power
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Drawing cell wall structure.
Any other activity	Nil

Synopsis

Cell wall is outer most protective layer in plants but absent in animals.
Cell wall synthesized by protoplasm.

Cell wall structure:

1. **Middle lamella**: cement layer, made up of calcium and magnesium pectates.
2.
3. **Primary cell wall:** cellulose, hemicellulose, pectin and other polysaccharides. Elastic in nature.
4. **Secondary cell wall**: present in mature cells. Made up of lignin, suberin, pectin, tannins, wax etc. it has S1, S2, S3 layers.

Growth of cell wall:

1. Intussusception: micro fibrils filling the blanks of existing cell wall. Surface area increased.

2. Opposition: micro fibrils deposit on surface of existing cell wall. Thickness of wall increased.

Pits :

1. **Primary pits:** present in primary wall. Allow plasmadesmata through them.

2. **Secondary pits:** present in secondary wall. These are two types
   a) Simple pits:

   b) Bordered pits:

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Structure and function of cell membrane
Hours Required	3
Learning Objectives	Distinguish prokaryotic and eukaryotic cells
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	Archaebacteria , BGA, plant and animal cell.
Additional Inputs	Nil
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany 2. Cell biology by C.B. Power
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Nil

Synopsis

The membrane surrounding cytoplasm in all cells is called plasma membrane.
It is made up proteins and lipids.

Chemistry of membrane:

1. Made up of proteins and lipids. Present in 1: 0.8 to 1: 4. 75 A in thickness.
2. **Lipids:** are phospholipids, glycolipids and sterols.
3. Phospholipids are bipolar in nature having hydrophilic head made by phosphate and hydrophobic tail made by fatty acids.
4. Phospholipids are lecithin, choline and cephalin.
5. Glycolipids have sugar, fatty acids and spingosine.
6. Sterols are present in animal cells.
7. **Proteins:**3 types 1. Structural 2. Functional- enzymes 3. Carrier proteins. Based on position 1. Extrinsic and 2. Intrinsic proteins.

Ultra structure of plasma membrane- models:

1. **Lipid bilayer model:** proposed by Gorter and Grendel.
2. **Daveson- Daniel model:**
3. **Unit membrane model:** proposed by Robertson.
4. **Fluid-mosai model:**proposed by Singer and Nicolson.
5. **Micellar model:** proposed by Hoffmann and Hilleir.

Functions: 1. Compartmentalization **2.** Selectively permeable. **3.**Transport mechanism.
4.Responding stimuli.
5.Co-ordination.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Chromosomes
Hours Required	4
Learning Objectives	Distinguish prokaryotic and eukaryotic cells
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	Archaebacteria , BGA
Additional Inputs	Animal cell
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany 2. Cell biology by C.B. Power 3. Genetics by B.D. Singh 4. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Nil
Synopsis	

1. Morphology:
   a) Hereditary vehicles.
   b) Discovered by Hofmeister in Tradescantia.
   c) Haploid- 1 genome, diploid- 2 genomes, triploid- 3 genomes and so on.
   d) Chromosome covered by pellicle.
   e) **Centromere or primary constriction**: kinetochore
   f) Monocentric, dicentric, polycentric and acentric.
   g) Metacentric, sub-metacentric, acrocentric and telocentric
   h) **Secondary constriction**: Has genes of RNA production.
   i) **Satellite**: knob like structure after secondary constriction.
   j) **Telomere:** terminal part of chromosome and provide polarity to chromosome.

2.Organization DNA in a chromosome – Nucleosome concept:
   a) Chromatin has 60% of proteins, 35% DNA and 5% RNA.
   b) Proteins are histones.
   c) Electron microscopic structure shows beaded like structures called nucleosomes.
   d) Nucleosome has core and DNA
   e) Histones are H1,H2,H3 and H4. Two copies of H2A, H2B, H3 and H4 form core (octamer) and H1 present in linker DNA.
   f) DNA coils by 2 turns around core and measures 146bp.
   g) Between nucleosomes linker DNA of 54bp is present.

2. Euchromatin and heterochromatin:
   a) Euchromatin is uncondensed light coloured and active DNA.
   b) Heterochromatin is condensed thick coloured and inactive DNA.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	DNA as genetic material.
Hours Required	4
Learning Objectives	Distinguish prokaryotic and eukaryotic cells
Previous Knowledge to be reminded	Whittaker five kingdom classification.
Examples/Illustrations	Archaebacteria , BGA
Additional Inputs	Animal cell
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany 2. Cell biology by C.B. Power
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	To prepare DNA models.
Any other activity	Nil
Synopsis	

Griffith Experiment & Transforming Principle

Frederick Griffith experiments were conducted with Streptococcus pneumoniae.

Two forms of bacteria 1. S- Strain with capsule and 2. R- Strain without capsule.

Experiment: Griffith injected both S and R strains to mice. The one which was infected with the S strain developed pneumonia and died while that infected with the R strain stayed alive.

In the second stage, Griffith heat-killed the S strain bacteria and injected into mice, but the mice stayed alive.
Then, he mixed the heat-killed S and live R strains. This mixture was injected into mice and they died. In addition, he found living S strain bacteria in dead mice.

Conclusion: Based on the observation, Griffith concluded that R strain bacteria had been transformed by S strain bacteria. The R strain inherited some 'transforming principle' from the heat-killed S strain bacteria.

DNA as Genetic Material

Griffith failed to explain the biochemistry of genetic material. A group of scientists, Oswald Avery, MacLeod and McCarty continued the Griffith experiment in search of biochemical nature of the hereditary material and found DNA as genetic material.

Avery and his team extracted and purified proteins, DNA, RNA and other biomolecules from the heat-killed S strain bacteria and by using proteases and RNases found that they didn't inhibit transformation but DNase did. They concluded DNA as genetic material.

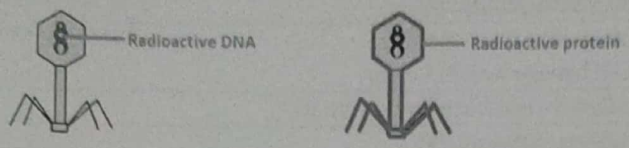
Hershey-Chase Experiment

Hershey-Chase experiment was performed in 1952 to further confirm that DNA was the genetic material. They experimented with Bacteriophages

Bacteriophages were grown in two different mediums.

Some bacteriophages were grown in **radioactive phosphorus medium**. It was found that these Bacteriophages came up with **radioactive DNA**

Some bacteriophages were grown in **radioactive sulfur medium**. It was found that these Bacteriophages with **radioactive protein**.



Bacteriophages with Radioactive DNA were brought in contact with bacteria
Bacteria got infected
Agitated in a blender to separate phage particles from bacterial cells
Centrifugation leaves Phage particles as supernatant
Bacterial cells were found to be radioactive
No radioactivity was detected in the phage particles

Bacteriophages with Radioactive protein were brought in contact with bacteria
Bacteria got infected
Agitated in a blender to separate phage particles from bacterial cells
Centrifugation leaves Phage particles as supernatant
Phage particles were found to be radioactive
No radioactivity was detected in the bacterial cells
It was therefore concluded that it was not the proteins, rather DNA which entered into the bacteria. Therefore, DNA causes the replication of viruses inside the bacteria.

DNA was thus proved to be the genetic material.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	DNA structure
Hours Required	2
Learning Objectives	Distinguish prokaryotic and eukaryotic cells
Previous Knowledge to be reminded	Biomolecules.
Examples/Illustrations	Nitrogen bases, pentose
Additional Inputs	Monosaccharide.
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany 2. Cell biology by C.B. Power
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	To prepare DNA models.
Any other activity	Nil

Synopsis

The DNA is a polymer of nucleotides. A nucleotide is made up nitrogen base, pentose sugar and phosphate group. Nitrogen base and pentose (deoxy-ribose) bound by glucosidic bond to form nucleoside which further bound to phosphate by phosphoester bond to form nucleotide.

The DNA molecule consists of 4 nitrogen bases, namely adenine (A), thymine (T), cytosine (C) and Guanine (G) which ultimately forms the structure of a nucleotide.

The A and G are purines and the C and T are pyrimidines.

Nucleotides connected by phosphodiester bonds to a DNA strand.

The two strands of DNA run in opposite directions. These strands are held together by the hydrogen bond that is present between the two complementary bases. The strands are helically twisted, where each strand forms a right-handed coil and ten nucleotides make up a single turn.

The pitch of each helix is 3.4 nm. Hence, the distance between two consecutive base pairs (i.e., hydrogen-bonded bases of the opposite strands) is 0.34 nm.

The DNA coils up, forming chromosomes, and each chromosome has a single molecule of DNA in it. Overall, human beings have around twenty-three pairs of chromosomes in the nucleus of cells. DNA also plays an essential role in the process of cell division.

Chargaff's Rule

Erwin Chargaff, a biochemist, discovered that the number of **nitrogenous bases in the DNA** was present in equal quantities. The amount of A is equal to T, whereas the amount of C is equal to G.

In all organisms should have a 1:1 ratio of purine and pyrimidine bases. **A=T; C=G**

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding.
Name of the Topic	Semi-conservative method of DNA replication.
Hours Required	2
Learning Objectives	Distinguish prokaryotic and eukaryotic cells
Previous Knowledge to be reminded	nil
Examples/Illustrations	Double helical model.
Additional Inputs	Conservative method.
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany 2. Cell biology by C.B. Power
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	To watch videos of DNA replicatin.
Any other activity	Nil
Synopsis	

DNA Replication: 1. Conservative method. 2. Semi-conservative method. 3. Dispersive method.

DNA replication is an important process that occurs during cell division. It is also known as semi-conservative replication, during which DNA makes a copy of itself.

DNA replication takes place in three stages :

Step 1: Initiation

The replication of DNA begins at a point known as the origin of replication. The two DNA strands are separated by the DNA helicase. This forms the replication fork.

Step 2: Elongation

DNA polymerase III reads the nucleotides on the template strand and makes a new strand by adding complementary nucleotides one after the other..

While adding nucleotides to the lagging strand, gaps are formed between the strands. These gaps are known as Okazaki fragments. These gaps or nicks are sealed by ligase.

Step 3: Termination

The termination sequence present opposite to the origin of replication terminates the replication process. The TUS protein (terminus utilization substance) binds to terminator sequence and halts DNA polymerase movement. It induces termination.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Cell theory and prokaryotic and eukaryotic cell
Hours Required	2
Learning Objectives	Types of RNAs
Previous Knowledge to be reminded	Genetic material.
Examples/Illustrations	t-RNA, m- RNA and r-RNA
Additional Inputs	Replication, transcription.
Teaching Aids Used	Black board, laptop, ppt
References Cited	1.Telugu Akademi - Botany 2. Cell biology by C.B. Power
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Nil
Synopsis	

Structure of RNA: The ribonucleic acid has all the components same to that of the DNA with only 2 main differences within it. RNA has the same nitrogen bases called the adenine, Guanine, Cytosine as that of the DNA except for the Thymine which is replaced by the uracil. Adenine and uracil are considered as the major building blocks of RNA and both of them form base-pair with the help of 2 hydrogen bonds.

Functions of RNA

1. The primary functions of RNA: Facilitate the translation of DNA into proteins
2. Functions as an adapter molecule in protein synthesis
3. Serves as a messenger between the DNA and the ribosomes.

RNA Types

1. **tRNA – Transfer RNA**: transfer amino acids to the site of protein synthesis. Shows clover leaf model

2. **rRNA-Ribosomal RNA**: involved in ribosome synthesis. In all living cells, the ribosomal RNA plays a fundamental role in the synthesis and translation of mRNA into proteins.

3. **The mRNA – Messenger RNA**: This type of RNA functions by transferring the genetic material into the ribosomes and pass the instructions about the type of proteins, required by the body cells. Therefore, the mRNA plays a vital role in the process of transcription or during the protein synthesis process.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Mendelian Inheritance
Hours Required	3
Learning Objectives	Student will know hybridization, back cross and test cross
Previous Knowledge to be reminded	Fertilization, Recombination.
Examples/Illustrations	Mule, pomato.
Additional Inputs	Sexual reproduction in plants
Teaching Aids Used	Black board, laptop.
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh
Student Activity Planned after teaching	Interaction.
Activities planned outside the class	Nil
Any other activity	Nil

Synopsis

Selection of pea plant for hybridization experiments:

1. Annual plants with short life cycle and easy t grow.
2. Self-pollinated and cross pollination is possible.
3. Pairs of Contrasting characters are present.

Reasons for Mendel success:

1. Selection of pea plant.
2. Selection of seven pairs of characters for hybridization.
3. Considering one character at a time.
4. Increasing complexity in hybridization experiments.
5. Mathematical analyses of results.

Mon hybridization: cross between two plants differ in one character.

Ex: Tall X dwarf

In F1 generation all tall plants are resulted.

When F1 plants are self-crossed, tall and dwarf plants produced in 3:1 ratio(phenotypic ratio) and 1:2:1 (genotypic ratio)

Law of dominance: The hybrid, having two contracting alleles will express only one trait in the phenotype called dominant allele or character and second allele is recessive.

Di hybridization: the cross between two plants differs in two pairs of contrasting characters.

Ex: yellow, round seeds X green, wrinkle seeds.

In F1 generation all seeds are yellow and round.

When F1 plants are self-crossed 4 types of plants produced in 9:3:3:1 ratio(phenotypic ratio) and 1:2:1:2:4:2:1:2:1(genotypic ratio).

Law of independent assortment:when two pairs of alleles are present in hybrid the pair of one allele will assort independent of another pair

Back cross: the cross between F1 plants and any one of the parents.

Test cross: the cross between F1 plant and recessive parent plant. It is useful to the genotype of hybrid plant. It is 1:1 for monohybrid cross and 1:1:1:1 in dihybrid cross.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Chromosome theory of inheritance
Hours Required	2
Learning Objectives	Student will know role of chromosomes in inheritance.
Previous Knowledge to be reminded	Fertilization, Recombination, chromosome structure.
Examples/Illustrations	Gene, allele
Additional Inputs	Nucleosome concept.
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Nil
Synopsis	

Chromosomal theory of inheritance

- In 1902 and 1903, Sutton and Boveri published independent papers proposing the chromosome theory of inheritance.
- According to Chromosomal theory of inheritance, chromosome is the genetic material responsible for Mendelian inheritance. At that time, Mendel knew nothing of the chromosomes and meiosis.
- In order to explain the law of independent assortment Sutton and Boveri suggested that different genes were in different chromosomes completely independent of one another.
- This theory states that individual genes are found at specific locations on particular chromosomes, and that the behavior of chromosomes during meiosis can explain why genes are inherited according to Mendel's laws.
- Thus, similarity between the Mendelian factors and chromosomes became apparent.

Morgan's experiments on ***Dorsophila melanogaster*** to explain chromosomal theory of inheritance

i. *Cross between Red eyed female (Xw+ Xw+) and white eyed male (Xw Y)*
ii. *Reciprocal cross- red eyed male (Xw+ Y) and white eyed female (XwXw)*

NON disjunction as proof of chromosomal theory of Inheritance: Bridges experiment.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Linkage
Hours Required	4
Learning Objectives	Student will learn types of linkage and reasons of linkage.
Previous Knowledge to be reminded	Dihybridization.
Examples/Illustrations	Cross in Lathyrus , drosophila.
Additional Inputs	Coupling and repulsion.
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction
Activities planned outside the class	Nil
Any other activity	Nil

Synopsis

The genes on a chromosome are linked and inherit together for generations.

All genes on a chromosome are called linkage group.

1. Coupling: in Lathyrus odoratus.
   Blue, long pollen X red and round pollen

   BBLL bbll

Resulted in all blue and long pollen in F1.

But in test cross instead of 1:1:1:1 ratio 7:1:1:7 is obtained.

2. Repulsion: in Lathyrus odoratus
   Blue and round pollen X red and long pollen

   BBll bbLL

Resulted in all blue and long pollen.

But test cross instead 1:1:1:1 ratio 1:7:7:1 is obtained.

Types of linkage:

1. Complete linkage
2. Incomplete linkage

Linkage maps: T.H. Morgan

1. Genes are arranged linearly on a chromosome called linkage group.
2. The number of linkage groups is equal to haploid number of chromosomes.
3. Linked genes separate when cross over takes place.
4. Linkage strength is inversely proportionate to distance between genes.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Crossing over
Hours Required	3
Learning Objectives	Student will prepare chromosomal maps by recombination frequency.
Previous Knowledge to be reminded	Linkage.
Examples/Illustrations	2 point test cross, 3 point test cross.
Additional Inputs	Chromosomal maps
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction.
Activities planned outside the class	Home work on chromosomal maps.
Any other activity	Nil
Synopsis	

Crossing over definition: exchange of chromatid segments between non-sister chromatids of homologous chromosomes.

Crossing over frequency: number of recombinants / total progeny X 100.

Factors effecting rate of crossing over:

1. High and low temperatures increase C.O rate.
2. X- rays increase rate
3. Gene mutations decrease rate.
4. Interference- Distance between genes
5. Colchicine reduce rate

Mechanism of crossing over:

1. In pachytene of prophase 1 of meiosis.
2. Endonuclease, exchange and ligase.

Theories of crossing over:

1. Classical theory.
2. Chiasma type theory.
3. Copy- choice theory.

Cytological detection of crossing over: stern experiment in Drosophila.

Kinds of crossing over:

1. Single cross-over:
2. Double cross-over:
3. Multiple cross-over:

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Objectives of of plant breeding
Hours Required	1
Learning Objectives	Student will learn Objectives of of plant breeding
Previous Knowledge to be reminded	Mendelian inheritance
Examples/Illustrations	Monohybrid cross, dihybrid cross
Additional Inputs	
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction.
Activities planned outside the class	Home work on chromosomal maps.
Any other activity	Nil
Synopsis	

Definition:

Plant breeding is a science based on principles of genetics and cytogenetic. It aims at improving the genetic makeup of the crop plants.

Objectives of Plant Breeding :

1. Higher yield : The ultimate aim of plant breeding is to improve the yield of "economic produce on economic part". It may be grain yield, fodder yield, fibre yield, tuber yield, cane yield or oil yield depending upon the crop species. Improvement in yield can be achieved either by evolving high yielding varieties or hybrids.

2. Improved quality: Quality of produce is another important objective in plant breeding. The quality characters vary from crop to crop. Eg. grain size, colour, milling.

3. Abiotic resistance : Crop plants also suffer from abiotic factors such as drought, soil salinity, extreme temperatures, heat, wind, cold and frost, breeder has to develop resistant varieties for such environmental conditions.

4. Biotic resistance : Crop plants are attacked by various diseases and insects, resulting in considerable yield losses. Genetic resistance is the cheapest and the best method of minimizing such losses.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Methods of crop improvement- introduction
Hours Required	3
Learning Objectives	Student will learn Methods of crop improvement- introduction
Previous Knowledge to be reminded	Mendelian inheritance
Examples/Illustrations	Monohybrid cross, dihybrid cross
Additional Inputs	Chromosomal maps
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction.
Activities planned outside the class	Home work on chromosomal maps.
Any other activity	Nil
Synopsis	

Plant introduction Definition :

Taking a genotype or a group of genotypes in to a new place or environment where they were not grown previously. Thus introduction may involve new varieties of a crop already grown in that area, a wild relative of the crop species or totally a new crop species for that area.

E.g. a) Introduction of IRRI rice varieties..

Plant introduction may be of two types. 1. Primary Introduction and 2. Secondary Introduction.

Objectives of Plant Introduction :

To introduce new plant species there by creating ways to build up new industries.E.g. Oil palm

- To introduce high yielding varieties to increase food production. E.g. Rice and wheat.
- To enrich the germplasm collection. E.g. Sorghum, Groundnut.
- To get new sources of resistance against both biotic and abiotic stresses.

Functions of NBPGR

1.Introduction maintenance and distribution of germplasm

2. Provide information about the germplasm through regular publications.

3. Conduct training courses to the scientist.

4. Conduct exploratory surveys for the collection of germplasm.

5. To set up Natural gene sanctuaries.

Merits of plant introduction.

1. It provides new crop varieties, which are high yielding and can be used directly

3. Provides parent materials for genetic improvement of economic crops.

5. Introduction may protect certain plant species in to newer area will save them from diseases. E.g. Coffee and Rubber.

Demerits

1. Introduction of new weed unknowingly.E.g. Argemone mexicana, Eichornia and Parthenium.

2. **Acclimatisation**: When superior cultivars are introduced in a new area, they generally fail initially to produce a phenotypic expression similar to that in their place of origin.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Methods of crop improvement- selection
Hours Required	4
Learning Objectives	Student will learn Methods of crop improvement-selection.
Previous Knowledge to be reminded	Mendelian inheritance
Examples/Illustrations	Monohybrid cross, dihybrid cross
Additional Inputs	Chromosomal maps
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction.
Activities planned outside the class	Home work on chromosomal maps.
Any other activity	Nil
Synopsis	

Selection in Self-Pollinated Crops

To get successful results by selection there are two pre-requisites.

a.Variation must be present in the population. b) The variation must be heritable.

Pureline Selection: The concept of pureline was proposed by Johannsen on the basis of his studies with beans (Phaseolus vulgaris) variety called Princess

A large number of plants are selected from a self pollinated crop. The selected plants are harvested individually. The selected individual plants are grown in individual rows and evaluated and best progeny is selected, yield tested and released as a variety.

Characteristics of purelines

1. All plants within a pure line have the same genotype.
2. The variation with in a pureline is environmental and nonheritable.
3. Purelines become genetically variable with time due to natural hybridization, mutation and mechanical mixture

General steps for making a pureline selection

First Season: From the base population select best looking plants having the desirable characters. Harvest them on single plant basis.

Second Season: The selected single plants are grown in progeny rows and estimate the performance. Reject unwanted progenies.

Third Season: Repeat the process of second season.

Fourth Season: Grow the selected single plants in replicated preliminary yield trial along with suitable check or control variety.

Fifth Season: Conduct regular comparative yield trial along with check variety and select the best culture.

Sixth Season: Conduct multilocation trial in different research stations along with local check. **Seventh Season**: Conduct Adaptive Research Trial in farmer's field. Fix the best yielder and release it as a variety thro' Variety Release committee.

Advantage of pureline selection.

1.Achieves maximum possible improvement over the original variety. 2. Extremely uniform in appearance.

Disadvantages: 1. It does not have wide adaptability because improvement is made only in the local variety. 2. Time required for developing a variety is more when compared to mass selection.

2.Mass Selection:

Here a large number of plants having similar phenotype are selected and their seeds are mixed together to constitute a new variety. Thus the population obtained-from selected plants will be more uniform than the original population. However they are genotypically different.

Steps

First season : From the base population select phenotypically similar plants, which may be 200 2000. Harvest the selected plants as a bulk.

Second season: The bulk seed is divided into smaller lots and grown in preliminary yield trial along with control variety. Dissimilar phenotypes are rejected. Higher yielding plots are selected.

Third to Sixth Season: With the selected lots conduct yield trials along with appropriate check or control. Select the best one and release it as a variety.

Merits of Mass Selection

1.Varieties developed will be having more adaptability since each plant is genotypicaly not similar. They have buffering action against abnormal environment. 2. Time taken for release of a variety is less. 3. The genetic variability present in the original population is maintained.

Demerits: 1. Compared to pure line variety they may not be uniform. 2. In the absence of progeny test we are not sure whether the superiority of selected plant is due to environment or genotype. 3. May not be as uniform as that of a pureline variety and certification is difficult.

Clonal selection:

progenies of a single plant are called a clone.

A clone may be defined as a group of individuals of like genotypic composition traceable through asexual reproduction to a single ancestral zygote.

Selection of desirable clones from the mixed population of vegetative propagated crops is known as clonal selection.

Clonal selection is a method of improving vegetatively propagated crops like sugarcane, banana, potato, citrus, mango, etc.

All the plants of a clone are similar, phenotypically and genotypically. Sugar cane is usually propagated through stem cuttings.

Mint and Chrysanthemum bear suckers at the base of aerial shoots.

After growing for some distance, the suckers grow out and produce new crowns.

The suckers may form independent plants.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Methods of crop improvement- hybridization.
Hours Required	3
Learning Objectives	Student will learn Methods of crop improvement-hybridization.
Previous Knowledge to be reminded	Mendelian inheritance
Examples/Illustrations	Monohybrid cross, dihybrid cross
Additional Inputs	
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction.
Activities planned outside the class	Home work on chromosomal maps.
Any other activity	Nil
Synopsis	

Hybridization in simple terms is defined as the breeding of two different organisms from genetically diverse groups or species.

Types of hybridisation:

Interspecific Hybridization: It can be defined as hybridization between two different species of the same genus.

Intergeneric Hybridization: It can be defined as hybridization between organisms of two different genera.

The Procedure of Hybridization

There are generally eight steps to hybridization, they are as follows:

Selection of Plant: It is referred to as choosing both the parental plants for the process, the plant must be healthy and can grow in the given condition are the two main prerequisites of the process.

Homozygosity: Inducing homozygosity in the parental plants is important to establish the purity of lines, that is eliminating the unwanted traits. It is achieved by self-pollination or selfing of the parental plants over generation to achieve the result.

Emasculation: It can be defined as the process of removal of male reproductive organs from the flower. It is mainly performed in bisexual flowers and is avoided in unisexual flowers. It is done prior to pollen shading. There are the following methods that are used for emasculation, scissors Method, hot water treatment, alcohol treatment, and suction.

Bagging: It can be defined as a method to cover the ovum of the flower. It is done to prevent cross-pollination of the flower by other pollen. The bags are made up of paper, butter paper, and vegetable parchment paper.

Tagging: It is the process of attaching a tag to the emasculated plant, which contains information about, the number of field records, date of emasculation, date of crossing, and name of the plant to which it is crossed.

Crossing: In this process pollen from selected parents is placed on the stigma of the flower.

Harvestation: The seeds from this progeny are collected, and are stored with the original tag.

F1 Generation: The seeds give rise to the filial one generation which is then subjected to a selection of hybrids among it.

Selection of Hybrids: There are various methods for selecting hybrids, the simple and widely used is selection based on phenotypic traits of the hybrid, these phenotypic traits are called morphological markers. Other techniques include the use of a molecular marker and cytogenetic analysis.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Mutation breeding
Hours Required	4
Learning Objectives	Student will about mutations and their role in crop improvement
Previous Knowledge to be reminded	Plant breeding types
Examples/Illustrations	2 point test cross, 3 point test cross
Additional Inputs	Causes of mutations.
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction.
Activities planned outside the class	Home work on chromosomal maps.
Any other activity	Nil
Synopsis	

The mutation can be classified as follows:

1. Changes in genes

2. Changes in chromosomal number (polyploidy, haploidy, heteroploidy)

3. Changes in the arrangement of the chromosomal segments due to

(a) Intra-chromosomal segmental rearrangements (Inversions)

(b) Inter-chromosomal segmental rearrangements (Translocations)

(c) Losses and duplication of chromosomal segments (Deletions and Deficiency)

Mutations have certain general characteristics which are summarised as below:

(i) Mutations are random i.e., they may come in a gene. However, some gene show higher mutation rates than others.

(ii) Mutations are generally lethal or harmful to the organism, a small proportion (0.1%) of all the induced mutations are useful.

(iii) Mutations are recurrent, i.e., the same mutation may occur repeatedly or again and again.

(iv) Induced mutations generally show pleiotropy (single gene affecting two or more different characters) often due to mutations in closely linked genes.

(v) Mutations provide the raw material for evolution.

(vi) Origin of mutation is unpredictable and haphazard.

(vii) Mutations are reversible i.e., an allele that arose through mutations of a gene can in turn mutate back to the original form of the gene. This is known as back mutation.

Role of Mutation in Plant Breeding:

It has been used for improving qualitative and quantitative characters including disease resistance and yielding ability of various crops.

The various applications of mutation breeding may be given as below:

(i) F_1 hybrids produced from hybridization may be treated with various mutagens to increase genetic variability and to facilitate recombination among linked genes. This method has not been extensively used.

(ii) Various mutagens have been used to improve different quantitative characters specially yield. By this technique various varieties have been developed so far which have shown high yielding performance.

(iii) In the case of clonal crops which are highly heterozygous in nature, mutagenesis is only the best method to bring about improved specific characteristic of clones without modifying their genetic make up. e.g., 'red sports' in apple etc. In other words, it is useful to improve specific characteristics of a well adopted high yielding variety.

(iv) Mutation breeding serves as a useful supplement to the available germplasm. It should be well understood that mutation breeding cannot minimise the necessity of collection of germplasm.

(v) Mutation have been found useful in certain specific characters like seed setting. Much more work has been done in Sweden by Gustafson 1954, 1960, Nybora 1954, Mackey, 1956, Smith 1951, where mutagenic agents are applied over many cultivated crop plants including garden trees.

Likewise, a huge amount of work has been done in east Germany on soya bean and barley by Scholz 1960, Zacharias 1956, Stubbe 1959 and in U.S.A. on Arachis hypogea. (pea-unit) by Gregory (1956). A variety of barely named Pallas and of pea named Stral has been developed by X-ray irradiation The mutant variety of barley is different in quality than its parent in following ways- (a) Early maturity (b) hard stem (c) more diastase activity (d) bold seeds and (e) disease resistance etc.

(vi) Irradiation of distant hybrids has been done to produce translocations. This is done to transfer a segment of chromosome having a desirable gene from the alien chromosome to the chromosome of a cultivated species of crop.

(vii) As a result of mutagenesis more than 335 varieties have been produced in different countries of the world. Such mutant varieties may be exemplified as in cereals, vegetables, millets, oil seeds, pulses, fruit trees etc. but paddy, barley, wheat account for 50% of the mutant varieties in all the crops. These crop varieties belong to diploid and polyploid, sexually and asexually reproducing species.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Somaclonal variations in crop improvement.
Hours Required	
Learning Objectives	Student will learn definition and role of Somaclonal variations in crop improvement
Previous Knowledge to be reminded	Mendelian inheritance
Examples/Illustrations	Monohybrid cross, dihybrid cross
Additional Inputs	Methods to obtain somaclonal variations.
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction.
Activities planned outside the class	Home work on chromosomal maps.
Any other activity	Nil
Synopsis	

Somaclonal variation and crop improvement

Larkin and Scowcroft (1981) proposed the term somaclone to describe the plants originating from any type of tissue culture. Genetic variation found to occur between somaclones in plant tissue cultures was called somaclonal variation.

The usefulness of variation was first demonstrated through the recovery of disease resistant plants in potato (resistance against late blight and early blight) and sugarcane (resistance against eye-spot disease, Fiji disease and downy mildew)

Genetic variation –

mutations or other changes in the DNA of the tissue those are heritable. This is only transmitted to the next generation and is thus important for crop improvement.

In several crops R0, R1 and R2 progenies were analyzed for genetic analyses and 3:1 segregation leading to the isolation of true breeding variants was observed.

Explant derived variation

The most stable cultures are obtained from meristematic tissue of a mature plant or tissues of a very young organ of meristematic nature. Polyploid cells can give more variability than diploids

Isolation of somaclonal variants

The various approaches to the isolation of somaclonal variants can be grouped into two broad categories: (i) screening and (ii) cell selection.

Advantages Somaclonal

This is because somaclonal variations are usually free from undesirable features like sterility, while induced mutations are generally associated with such defects, which necessitate one or two backcrosses with the parent variety.

A very effective selection can be practised at the cell level for several traits, e.g., disease resistance etc. This approach effectively selects few desirable cells from among millions with relatively small effort, time, cost and space requirements. This is the only approach for the isolation of biochemical mutants, especially auxotrophic mutants, in plants.

Limitations: The technique is applicable only to those species of cell cultures which regenerate complete plants. Selected cell lines often show reduced or no regeneration potential.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Cell Biology, Genetics and Plant breeding
Name of the Topic	Molecular breeding –use of DNA markers
Hours Required	4
Learning Objectives	Student will learn Molecular breeding –use of DNA markers.
Previous Knowledge to be reminded	Mendelian inheritance
Examples/Illustrations	Monohybrid cross, dihybrid cross
Additional Inputs	Marker types
Teaching Aids Used	Black board, laptop
References Cited	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
Student Activity Planned after teaching	Interaction.
Activities planned outside the class	Home work on chromosomal maps.
Any other activity	Nil
Synopsis	

Restriction Fragment Length Polymorphism (RFLP)

Restriction Fragment Length Polymorphism (RFLP) is a technique in which organisms may be differentiated by analysis of patterns derived from cleavage of their DNA.

If two organisms differ in the distance between sites of cleavage of particular Restriction Endonucleases, the length of the fragments produced will differ when the DNA is digested with a restriction enzyme.

The similarity of the patterns generated can be used to differentiate species (and even strains) from one another. This technique is mainly based on the special class of enzyme i.e. Restriction Endonucleases

Applications:

1. RFLPs can be applied in diversity and phylogenetic studies ranging from individuals within populations or species, to closely related species.

2. RFLPs have been widely used in gene mapping studies because of their high genomic abundance due to the ample availability of different restriction enzymes and random distribution throughout the genome (Neale & Williams 1991).

3. They also have been used to investigate relationships of closely related taxa ,as fingerprinting tools ,for diversity studies and for studies of hybridization, including studies of gene flow between crops and weeds 4. RFLP markers were used for the first time in the construction of genetic maps by Botstein et al.1980.

Random Amplified Polymorphic DNA (RAPD)

1. RAPD is a PCR-based technology.

2. The method is based on enzymatic amplification of target or random DNA segments with arbitrary primers.
3. In 1991 Welsh and McClelland developed a new PCR-based genetic assay namely randomly amplified polymorphic DNA (RAPD).

4. The principle is that, a single, short oligonucleotide primer, which binds to many different loci, is used to

amplify random sequences from a complex DNA template.

5. This means that the amplified fragment generated by PCR depends on the length and size of both the primer and the target genome.

6. The assumption is made that a given DNA sequence (complementary to that of the primer) will occur in the genome, on opposite DNA strands, in opposite orientation within a distance that is readily amplifiable by PCR.
7. These amplified products (of up to 3.0 kb) are usually separated on agarose gels (1.5- 2.0%) and visualised by ethidium bromide staining

8. The standard RAPD utilises short synthetic oligonucleotides (10 bases long) of random sequences as primers to amplify nanogram amounts of total genomic DNA under low annealing temperatures by PCR. Primers are commercially available from various sources

Advantages:

1. The main advantage of RAPDs is that they are quick and easy to assay.

2. Because PCR is involved, only low quantities of template DNA are required, usually 5–50 ng per reaction.

3. Since random primers are commercially available, no sequence data for primer construction are needed.

4. Moreover, RAPDs have a very high genomic abundance and are randomly distributed throughout the genome.

Disadvantages:

1. The main drawback of RAPDs is their low reproducibility (Schierwater & Ender 1993), and hence highly standardized experimental procedures are needed because of their sensitivity to the reaction conditions.

2. RAPD analyses generally require purified, high molecular weight DNA, and precautions are needed to avoid contamination of DNA samples because short random primers are used that are able to amplify DNA fragments in a variety of organisms

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DEPARTMENT OF BOTANY

TEACHING NOTES (2022-23)

SEM-V ,Paper-6A: Plant Propagation

K.Ravichandra Reddy

Lect.in Botany

PROFORMAFORTEACHINGPLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	K. Ravichandra Reddy
Course/Group	Sem -V
Paper	Paper–6A
Name of the Topoic	**Plant Propagation-Basic Concepts**
Hours required	3h
Learning objectives	To know about Routine Garden Operations
Previous Knowledge to be reminded	Routine Garden Operations
Examples/Illustrations	Plant examples
Additional Inputs	Photographs
Teaching aids used	Power Points
References Cited	Sharma RR and Manish Srivastav.2004.
Study activity planned after teaching	Group discussion/Class room quiz
Activity planned outside the class	observation
Any other activity	Informationcollection

Topic Synopsis:

Plant propagation refers to the multiplication of an individual plant or group of plants, which have specific value to mankind. Perpetuation of plants is called propagation. It involves multiplication of one plant into several plants − development of new individuals. New plants or new individuals are required for establishing **new plantings / new gardens/ new orchards**.

Methods of propagation: Broadly grouped in to two. (a) **Sexual** and (b)**asexual.**

Sexual (Seed) Propagation:

It refers to multiplication of plants by seed. In sexual process male and female gametes are fused to produce seed., **Seed** is the result of fusion of male and female gametes. Seeds are fertilized ovules, containing embryos resulting from the union of a male and a female gamete during fertilization. The embryo in the seed gives rise to a new plant on germination. Plants that are produced from seeds are called **seedlings.**

Advantages of Seed propagation:

1) Seedling trees generally live longer, bear more heavily and are hardier than vegetatively propagated trees.
2) Seedlings are comparatively cheap, and can be more easily raised than vegetatively propagated materials.
3) Plants which are difficult to propagate, e.g., papaya and phalsa by vegetative method can only be propagated by seed.

Disadvantages of seed propagation:

1) Owing to genetic segregation in heterozygous plants, seedling trees are not uniform in their growth, yielding capacity and fruit quality compared with asexually propagated plants. Seedling trees are not usually true to type and show variation.

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PROFORMAFORTEACHINGPLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	K. Ravichandra Reddy
Course/Group	Sem -V
Paper	Paper–6A
Name of the Topoic	**Plant Propagation-Facilities**
Hours required	3h
Learning objectives	To know about Routine Garden Operations
Previous Knowledge to be reminded	Routine Garden Operations
Examples/Illustrations	Plant examples
Additional Inputs	Photographs
Teaching aids used	Power Points
References Cited	Sharma RR and Manish Srivastav.2004.
Study activity planned after teaching	Group discussion/Class room quiz
Activity planned outside the class	observation
Any other activity	Information collection

Topic Synopsis:

For propagation, framed structures such as green house, poly tunnels, culture room, hardening chamber and mist chamber are some important structures. A greenhouse is a framed, infrastructure covered with a transparent material in which crops can be grown under at least partially controlled environment. Various designs of greenhouse viz., shade net house, plastic film green house, glass house and natural green houses may be designed according to the need and resource availability.

Shade Net House: A shade net nursery usually has 20 m x 10 m dimensions. It is erected using GI pipes as a support. UV stabilized HDPE green or black colour shade net of 50 to 75% shade intensity is used to cover the nursery area at a height of 6.5 feet. Wire grid is provided at the top of the structure as support for shade net. To prevent insect entry, 40 mesh UV stabilized nylon insect proof net is fitted on all the four sides of the nursery. Provision is also made to pull polythene sheet over the pro-trays in the event of rainfall by way of making low tunnel structure. For preparing low cost polytunnel structure, 3/4" LDPE pipes and 400 gauge UV stabilized polyethylene sheet are used. Sometime bamboo poles and polysheets may also be used.

Glass/Greenhouses:Glass house is preferred when the greenhouse is to be placed against the side of an existing building. It makes best use of sunlight and minimizes the requirements for roof supports. Consolidation of interior space reduces labor, lowers the cost of automation, improves personnel management, and reduces energy consumption. Glass greenhouse is seldom used today because they are not adaptable to automation. The construction cost of glass house is more than that of plastic film greenhouses. Several styles of glass greenhouses are designed to meet specific needs

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PROFORMAFORTEACHINGPLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	K. Ravichandra Reddy
Course/Group	Sem -V
Paper	Paper–6A
Name of the Topoic	**Plant Propagation-Identification &Propagation by division and Separation**
Hours required	3h
Learning objectives	To know about Routine Garden Operations
Previous Knowledge to be reminded	Stem Modifications
Examples/Illustrations	Plant examples
Additional Inputs	Photographs
Teaching aids used	Power Points
References Cited	Sharma RR and Manish Srivastav.2004.
Study activity planned after teaching	Group discussion/Class room quiz
Activity planned outside the class	observation
Any other activity	Information collection

TopicSynopsis:

Plant Propagation by Separation and Division

Many herbaceous species that die back at the end of the growing season have underground food storage organs that survive the dormant winter period. These organs are also vegetative propagation structures that produce new shoots in the growing season. The variety of underground storage organs may be grouped into two classes based on how they are propagated; plants propagated by separation and plants propagated by division

Plants propagated by separation: Separation is a method of propagation in which underground structures of plants are divided not by cutting but by breaking along natural lines between segments. Separation is breaking away of daughter structures from the parent structure to be used to establish new plants. Two specialized underground structures-bulbs and corms-produce such materials.-- **Bulb: Corm:**

Plant propagation by division: It is a method of propagation of plants using cut section of a particular part like rhizome, tuber,Stolon,Succer, and tuberous root etc.

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PROFORMAFORTEACHINGPLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	K. Ravichandra Reddy
Course/Group	Sem -V
Paper	Paper–6A
Name of the Topoic	**Apomictics in Plant Propagation**
Hours required	10 h
Learning objectives	Sexual and Asexual reproductio
Previous Knowledge to be reminded	Routine Garden Operations
Examples/Illustrations	Plant examples
Additional Inputs	Photographs
Teaching aids used	Power Points
References Cited	Sharma RR and Manish Srivastav.2004.
Study activity planned after teaching	Group discussion/Class room quiz
Activity planned outside the class	observation
Any other activity	Information collection

Topic Synopsis: Apomixis, derived from two Greek word "APO" (away from) and "MIXIS" (act of mixing or¬ mingling).

- The first discovery of this phenomenon is credited to Leuwen hock as early as 1719 in Citrus¬ seeds. In apomixes, seeds are formed but the embryos develop without fertilization. The genotype of the embryo and resulting plant will be the same as the seed parent

Definition:

"The process of development of diploid embryos without fertilization. " Or " Apomixis is a type of reproduction in which sexual organs of related structures take part but seeds are formed without union of gametes."

- In some species of plants, an embryo develops from the diploid cells of the seed and not as a result of fertilization between ovule and pollen.This type of reproduction is known as apomixis and the seedlings produced in this manner are known as apomicts.
- Apomictic seedlings are identical to mother plant and similar to plants raised by other vegetative means, because such plants have the same genetic make-up as that of the mother plant. Such seedlings are completely free from viruses.
- In apomictic species, sexual reproduction is either suppressed or absent.
- **When sexual reproduction also occurs, the apomixes is termed as facultative apomixis.**
- **But when sexual reproduction is absent, it is referred to as obligate apomixis.**

Types of Apomixis: Maheshwari (1950) classified apomixis into four groups:

1. **Recurrent Apomixis:**
2. **Non-Recurrent Apomixis:**
3. **Adventitious Embryony or Nucellar Embryony:**
4. **Vegetative apomixis or bulbils:**

5. Advatages

Assured reproduction in the absence of pollinators, such as in extreme environments

- Maternal energy not wasted in unfit offspring (cost of meiosis)
- Some apomictic plants (but not all) avoid the male energy cost of producing pollen

Disadvantages –

- Can't control accumulation of deleterious genetic mutations
- Usually restricted to narrow ecological niches Lack ability to adapt to changing environments.

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PROFORMAFORTEACHINGPLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	K. Ravichandra Reddy
Course/Group	Sem -V
Paper	Paper–6A
Name of the Topoic	**Plant Propagation-Poly Embryony**
Hours required	2h
Learning objectives	To know about Embryo& Polyembryo formation
Previous Knowledge to be reminded	Fertilization
Examples/Illustrations	Plant examples
Additional Inputs	Photographs
Teaching aids used	Power Points
References Cited	Sharma RR and Manish Srivastav.2004.
Study activity planned after teaching	Group discussion/Class room quiz
Activity planned outside the class	observation
Any other activity	Informationcollection

Types of Polyembryony-------1.Induced Polyembryony - **It is called so because it is induced experimentally. In this type, development of an embryo is managed in a culture medium(liquid or gel designed to support the growth of** microorganisms**).2.**Spontaneous Polyembryony - **This type occurs naturally.**

Herbert John Webber, an American Plant Physiologist had classified Polyembryony into three types:

- **Cleavage Polyembryony:** Cleavage Embryony occurs when a young embryo or **zygote** separates into two or more units. These units eventually develop into independent embryos. Sometimes, it is the result of proliferation of proembryo(the series of cells in the ovule of a flowering plant, after fertilisation but before the formation of embryo). It is common in gymnosperms and comparatively rare in angiosperms. Pinus is a popular example of this type. In it, zygote divides twice in order to form four nuclei.

- **Simple Polyembryony:** Simple Polyembryony is the result of fertilisation of more than one egg or many of the archegonia(a haploid structure that produces female **gamete**) eggs. Pinus is also a suitable example of Simple Polyembryony.

- **Rosette Polyembryony:** This occurs when additional embryos are developed in rosette cells in **gymnosperms**.

Ernst (1918) and Schnarf (1929) classified polyembryony into two kinds:

- **True Polyembryony:** This occurs when an embryo is produced in a single embryo sac. The supplementary embryo(s) are formed either from cleavage of the egg or from the antipodal cells or synergids.
- **False Polyembryony:** This is the phenomenon which occurs when two or more embryos develop in a single embryo sac.
- **Significance of Polyembryony-**Earlier, polyembryony was said to be an abnormal feature but now it is considered as a desirable character in citrus **fruits**, mango, jamun, rose, apple, almond, and so on. to obtain true value products. Thus it is a very important part of Horticulture and particularly, Nucellar adventive polyembryony is of great significance in it. It helps maintain the identicality between parent and progeny. Nucellar seedlings show restoration of vigour. Moreover, nucellar embryos are free from **disease**.

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PROFORMAFORTEACHINGPLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	K. Ravichandra Reddy
Course/Group	Sem -V
Paper	Paper–6A
Name of the Topoic	**Plant Propagation-CUTTINGS**
Hours required	10h
Learning objectives	To know about new plant generation by cuttings
Previous Knowledge to be reminded	Vegetative reproduction
Examples/Illustrations	Plant examples
Additional Inputs	Photographs
Teaching aids used	Power Points
References Cited	Sharma RR and Manish Srivastav.2004.
Study activity planned after teaching	Group discussion/Class room quiz
Activity planned outside the class	observation
Any other activity	Information collection

The process of propagation of plants by cuttings is known as cuttage. A cutting is a part of a plant that will produce roots when put in soil media and eventually produce a new plant quite true to the parent plant. A cutting may be a piece of stem, a leaf or part of a leaf, a piece of root, or root stock, or even a scale of bulb.

Classification of cuttings:

Cuttings are usually classified in to 3 groups according to the particular part of the plant used as cutting.

1) Stem cuttings
2) Root cuttings
3) Leaf cuttings

Stem cutting:

Stem cuttings can be divided in to 4 types based on the degree of maturity and lignification of wood used in making cuttings.

1.Hard wood stem cuttings
2.Semi hard wood stems cuttings
3.Soft wood stem cuttings
4.Herbaceous stem cuttings

Leaf Cuttings:

1.Leaf blade cutting

2. Leaf vein cutting / Leaf slashing
3. Leaf margin cutting
4. Leaf bud cutting

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PROFORMAFORTEACHINGPLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	K. Ravichandra Reddy
Course/Group	Sem -V
Paper	Paper–6A
Name of the Topoic	**Plant Propagation-LAYERING**
Hours required	10h
Learning objectives	To know about New plant generation by Layering
Previous Knowledge to be reminded	Vegetetive Reproduction
Examples/Illustrations	Plant examples
Additional Inputs	Photographs
Teaching aids used	Power Points
References Cited	Sharma RR and Manish Srivastav.2004.
Study activity planned after teaching	Group discussion/Class room quiz
Activity planned outside the class	observation
Any other activity	Informationcollection

Layering is the developing of roots on a stem while it is still attached to the parent plant. The rooted stem is then detached or become a new plant growing on its own roots. A layered stem is known as a layer.

Classification of layering:

I. Ground layering

1) Tip layering
2) Simple layering
3) Trench layering
4) Mound layering or stool layering
5) Compound or serpentine layering

II. Air layering. (Gootee or Marcottage).

Advantages:

i. It is an easy method and does not require much care and arrangement like cutting.

ii. The mother plant supplies nutrient and other metabolites as it remains attached while rooting.

iii. By using a large branch a much larger plant can be obtained in the first instance.

iv. Some plants that cannot be satisfactorily started from cuttings can be propagated by layering.

Disadvantages:

i. It is a costlier method.
ii. It is a slow process
iii. Limited number of plants can be propagated
iv. Layered plants are generally shallow rooted
v. Interference with cultivation
vi. Require more individual attention
vii. The beneficial effect of root stock cannot be exploited.

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PROFORMAFORTEACHINGPLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	K. Ravichandra Reddy
Course/Group	Sem -V
Paper	Paper–6A
Name of the Topoic	**Plant Propagation-GRAFTING**
Hours required	2h
Learning objectives	To know about Routine Garden Operations
Previous Knowledge to be reminded	Routine Garden Operations
Examples/Illustrations	Plant examples
Additional Inputs	Photographs
Teaching aids used	Power Points
References Cited	Sharma RR and Manish Srivastav.2004.
Study activity planned after teaching	Group discussion/Class room quiz
Activity planned outside the class	observation
Any other activity	Informationcollection

Grafting is an art of joining parts of two independent plants in such a manner that they unite and grow together into single independent plant.The part of graft combination which is to become the upper portion or the shoot system or top of the new plant is termed the **scion** or **cion** and the part which is to become the lower portion or the root system is the **rootstock** or **under stock** or some time **stock**. The single plant obtained as a result of union between the stock and scion is termed as **Stion**.

Methods of grafting:

Mainly in grafting there are two types.

Attached scion methods of grafting *and* ***detached scion methods of grafting.***

In attached scion methods of grafting the scion is still attached to the mother plant (Scion Plant) till the graft union takes place where as in detached scion methods of grafting the scion is separated from the scion plant or mother plant just before grafting. Under attached scion methods of grafting simple inarching or approach grafting is most important

Simple inarching / Approach grafting:

The distinguishing feature of this method of grafting is that two independent plants on their own roots (self-sustaining) are grafted together. This method provides a means of establishing a successful union between certain plants which are difficult to graft by any other method as the two plants will be on their own roots till the formation of successful graft. E.g., Guava, mango, Sapota.

In detached scion methods of grafting there are two types-they are ***side grafting*** and ***apical grafting*** methods**.**

Among the detached scion methods of grafting the important ones are described below.

Under side grafting method Veneer grafting is important and is described below.

Veneer grafting:

This is also a kind of side grafting with slight modification. It is used widely for grafting small potted plants and *insitu* grafting. E.g., Avocado, Mango etc.

Epicotyl (Stone) Grafting:

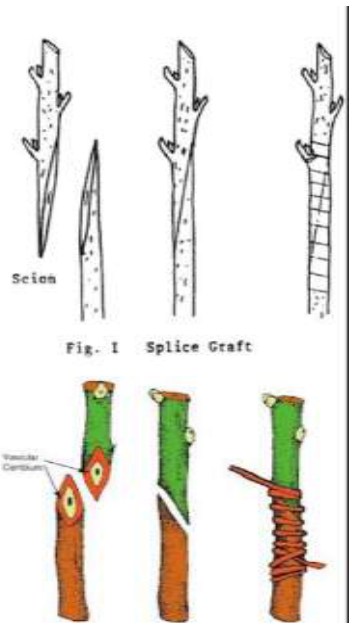
This method of grafting is done on the epicotyl region of the young seedlings; hence the name epicotyl grafting. E.g., Cashew, mango etc.

Soft wood grafting:

It has been developed to graft small and young rootstocks which are grown *in situ* or in pots. E.g., Cashew, Mango.

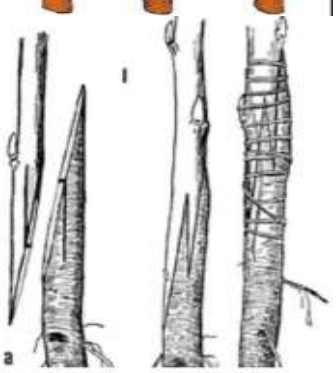
Splice grafting

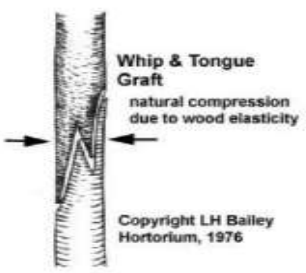
- This method is utilized in those plants which unite rapidly.
- Nearly equal size of slanting cut should be made on the lower end of scion and upper end of rootstock.
- These two cut surfaces are placed together, tightly tied and wrapped with polyethylene grafting tape.
- This method is generally practiced in those plant species which have pithy stem or have wood that is not flexible enough to permit tight fit.
- Should be performed during dormant period and the tying material must be cut after the parts of the graft have united.
- Any shoot growth in the rootstock should be removed.
- This method can be applied in apple, pear, cherries, etc.



Whip or tongue grafting

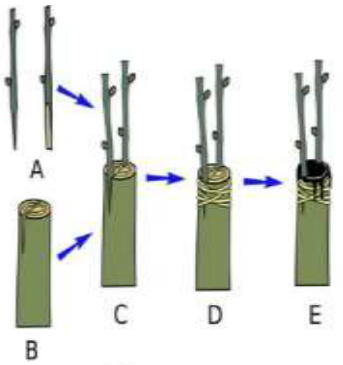
- Rootstock and scion are prepared in the same way as in splice grafting.
- The difference is that a tongue is made from a single cut on the cut surface of both scion and rootstock, so that the scion and rootstock will interlock each other by matching cambium layers.
- In this method the possible area of contact is greatly increased because of the creation of the tongue and the scion and stock are held more firmly by interlocking mechanism.
- After matching scion and rootstock together they are tied as in splice grafting.
- This method is commonly practiced in apple, pear etc.

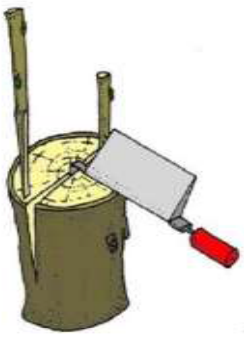




Cleft grafting

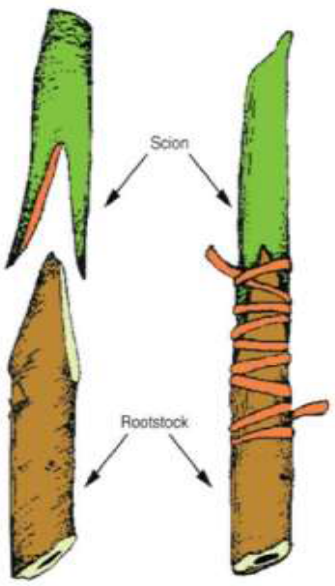
- This method is generally used for top working the trees.
- In this method, the limb or main stem of the stock to 1st sawed off at right angle and a vertical slit is made on the center at the stem deep enough to hold the scion.
- The scion is a prepared by cutting its basal end into a long tapering wedge which is inserted in the slit of the rootstock.
- In larger stocks two scions can be inserted, one in each side of the cleft.
- Proper placement of scion is very important so that there is good contact between the combium layers of scion and rootstock.
- In this method smaller scion can be used in bigger rootstocks.





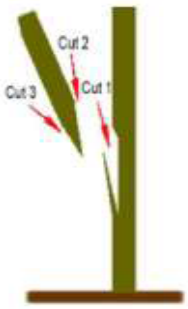
Saddle grafting

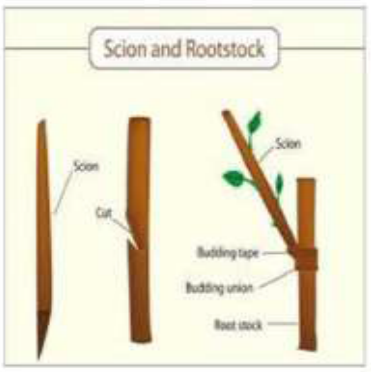
- A saddle (inverted v cut) cut is made at the lower end of scion.
- A tapering wedge is made on the top portion of stock.
- Both the components are fitted together by allowing the Cambium layers to come in contact.
- If the cut given in the scion is a wedge and that in stock is saddle (V shape), then the grafting is known as wedge grafting.



Side grafting

- In this method the basal portion of scion is joined at the side of the stock plant.
- A long sloping cut extending downward is made in rootstock.
- **If the cut given is V shaped then this side grafting is known as veneer grafting.**
- The scion is prepared by making a cut which can match on the cut surface of stock plant.
- After placing scion and stock together they are tied with polythene tape.
- This method can be successfully done in mango.





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PROFORMAFORTEACHINGPLAN	
Name of the Department/Subject	Department of Botany
Name of the lecturer	K. Ravichandra Reddy
Course/Group	Sem -V
Paper	Paper–6A
Name of the Topoic	**Plant Propagation-BUDDING**
Hours required	2h
Learning objectives	To know about Routine Garden Operations
Previous Knowledge to be reminded	Routine Garden Operations
Examples/Illustrations	Plant examples
Additional Inputs	Photographs
Teaching aids used	Power Points
References Cited	Sharma RR and Manish Srivastav.2004.
Study activity planned after teaching	Group discussion/Class room quiz
Activity planned outside the class	observation
Any other activity	Informationcollection

Plant propagation by budding

Budding is also a method of grafting wherein only one bud with a piece of bark and with or without wood is used as the scion material. It is also called as bud grafting. The plant that grows after union of the stock and bud is known as budding.

Methods of budding

T-Budding (Shield budding):

Inverted T- Budding:

Patch Budding:

Ring budding:

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DEPARTMENT OF BOTANY

2022-23

TEACHING NOTES

Paper 7A

SEED TECHNOLOGY

Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Seed and grain: Definitions, importance of seed; structure of Dicot and Monocot seed.
Hours Required	04
Learning Objectives	To learn structure of Dicot and Monocot seed
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Peas, beans, maize
Additional Inputs	Seeds of different plants
Teaching Aids Used	BLACK BOARD
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity Planned after teaching	SEMINAR, SLIP TEST, QUIZ
Activities planned outside the class	Nil
Any other activity	NIL
Synopsis	

Structure of a Dicot Seed

A typical dicot seed such as a bean seed has the following parts -

Hilum - It is a scar which marks the site of attachment of the seed to the ovary wall.
Micropyle - It is a pore that lies just below the hilum. Absorption of water and exchange of respiratory gases occurs through the micropyle.

Seed coat - Hard protective covering of the seed which consists of an outer testa and inner tegmen.

Opening up the seed exposes two massive and fleshy cotyledons which store food for the growing embryo.

The cotyledons are laterally attached to an embryonal axis which consists of a radicle and a plumule. The region between the radicle and the point of attachment of the cotyledons is known as hypocotyl. The region between the plumule and the point of attachment of the cotyledons is known as epicotyl Structure of a Monocot Seed

In a typical monocot seed such as maize the seed coat is membranous and fused with the fruit wall. Endosperm is bulky and stores food in the form of starch.

The outer layer of the endosperm is proteinaceous and is known as the aleurone layer. A thin layer called epithelium separates the embryo from the endosperm. Embryo is small and situated in a groove at one end of the seed. It has one large and shield shaped cotyledon which is in a reduced state and is known as scutellum. Short embryonal axis has a plumule and a radicle. The plumule is covered by a sheath called the coleoptile. The radicle is covered by a sheath called coleorhiza.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Role and goals of seed technology; characteristics of quality seed material.
Hours Required	03
Learning Objectives	To learn Role and goals of seed technology and characteristics of quality seed material
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Peas, beans, maize, food, oil, vegetables
Additional Inputs	Seeds of different plants
Teaching Aids Used	BLACK BOARD
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity Planned after teaching	SEMINAR, SLIP TEST, QUIZ
Activities outside the class	nil
Any other activity	NIL
Synopsis	

Role of seed technology:

1. Improved seed – a carrier of new technologies The introduction of quality seeds of new Varieties wisely combined with other inputs significantly increase yield levels. In India, the cultivation of high yielding varieties have helped to increase food production from 52 million tonnes to nearly 180 million tonnes over a period of 40 years.
2. Improved seed – a basic tool for secured food supply.

The successful implementation of the high yielding varieties programme in India has led to a remarkable increase in production and food imports from other counters have been brought down inspite of rapid increase in population.

3. Improved seed – the principal means to secure crop yields in less favorable areas of production. The supply of god quality seeds of improved varieties suitable to these areas is one of the important contribution to secure higher crop yields.
4. Improved seed – a medium for rapid rehabilation of agriculture in cases of natural disaster. In case of floods and drought affected areas the Govt. will provide the improved seeds from national seed stocks to rehabilate the agricultural production of foods grains in the country

Goals of Seed Technology:

The major goal of seed technology is to increase agricultural production through the spread of good quality seeds of high yielding varieties. It aims at the following:

1. Rapid multiplication: Increase in agricultural production through quickest possible spread of new varieties developed by the plant breeders. The time taken to make available the desired quantities of seeds of improved varieties to farmers should be considered as a measure of efficiency and adequacy in the development of seed technology in the country
2. Timely supply: The improved seeds of new varieties must be made available well in time, so that the planting schedule of farmer is not disturbed and they are able to use good seed for Planting purposes.
3. Assured high quality of seeds: This is necessary to obtain the expected dividends from the use of seeds of improved varieties.
4. Reasonable price:The cost of high quality seed should be with in reach of the average farmer.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Dormancy, causes and methods to break seed dormancy.
Hours Required	03
Learning Objectives	Skills on various methods to break the seed dormancy.
Previous Knowledge to be reminded	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	BLACK BOARD, LAPTOP
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
Activities planned outside the class	TO VISIT CROP FIELDS TO OBSERVE DISEASE SYMPTOMS OF VIRUS
Any other activity	NIL
Synopsis	

A physical or physiological condition of viable seed, which prevents germination even in the presence of favorable conditions.

The seed dormancy is divided in to three groups

1. Endogenous 2. Exogenous 3. Combined

Cause of seed dormancy/ factor responsible for seed dormancy: Genetical factor / cause:

1. Physiological 2. Embryo dormancy 3. Undeveloped cotyledon 4. Immature embryo

Coat imposed dormancy:

1. Seed coat factor: a. Seed coat impermeable to water b. Seed coat impermeable to oxygen c. Mechanically resistant seed coat.

2. Embryo factor: 1. Dormant embryo 2. Immature/ Rudimentary embryo

3. Inhibitory factors: Presence of germination Inhibitors in seeds

Methods of Breaking Seed Dormancy

Various methods have been used to break the dormancy of seed.

A. Scarification:

Any treatment i.e. physical or chemical that weakness the seed coat, is known as scarification.

1. Seeds are either rubbed on a sand paper manually.

2. When seed coat is too the seed coat has to be removing completely by breaking it.

3. Soaking treatment: in diluted solution of H_2SO_4 , it remove seed coat impermeability

B. Temperature Treatments:

1. When the dormancy is due to embryo factor i.e. the seed is incubating at low temp. (0- 5o C) over a substratum for 3 to 10 days placing it at optimum temp. E.g. mustard

2. Some seeds required a brief period of incubation) at 40 to 50 oC before germinating at required temp. e.g. paddy

3. Hot water treatment is also an effective method of breaking hard- seed ness in legumes. In this method the seeds are soaked in water at 80oC temp. For 1 – 5 minutes (depending up on the type of seed) before putting for germination.

C. Light Treatments: Same seeds do not germinate in dark thus it provides continuous or periodic exposure of light is essential e. g. Lettuce required red light (660nm) or white light is essential for germination to occur.

D. Treatments with growth regulators & other Chemicals: Endogenous dormancy may be due to presence of germination inhibitors. Application of growth regulators it can be removed.

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Name of theDepartment/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	Seed Technology
Name of the Topic	Seed processing and storage : Principles of seed processing
Hours Required	03
Learning Objectives	Determine seed moisture, seed germination percentage, seed viability and vigour.
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black Board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity Planned after teaching	Student seminar , Gram staining
Activities outside the class	Field visit
Any other activity	Nil
Synopsis	

Seed processing and storage

1. Put the seed into the bin to the recommended depth and there should be uniform distribution of trash and broken seeds.
2. Operate the dryer at recommended temperature for that seed using a thermostat.
3. When drying is completed, continue blowing air through seed without heat to bring the seed temperature down to air temperature or to 50oF if air temperature is lower. This may require around 30 minutes to 2 hours depending on the quantity being dried and the air temperature.

Seed Storage

Seeds are uniquely equipped to survive, as viable regenerative organisms until the time and place are right for the beginning of a new generation. However like other form of life, they cannot retain their viability indefinitely and eventually deteriorate and die. Fortunately neither nature nor agricultural practice ordinarily requires seeds to survive longer than the next growing season, though the seeds of most species are able to survive much longer under the proper conditions.

General principles of seed storage

1. Seed storage conditions should be dry and cool
2. Effective control of storage pests
3. Proper sanitation in seed stores
4. Before placing seeds into storage they should be dried to safe moisture limits, appropriate for storage system.
5. Store only high quality seed i.e. seeds which are well cleaned, treated, with high germination and vigour.
6. Determine seed storage needs in view of period or length of storage time and preveling climate of the area during storage period. Long-term storage requires more exacting conditions of seed storage than short-term

storage. Similarly, the regions with favourable storage climate, i.e., one where relative humidity is rather low, require less sophistication than areas of high relative humidity.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Seed storage; orthodox and recalcitrant seeds, natural longevity of seeds.
Hours Required	03
Learning Objectives	Determine seed moisture, seed germination percentage, seed viability and vigour
Previous Knowledge to be reminded	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity Planned after teaching	Student seminar
Activities planned outside the class	Nil
Any other activity	Nil
Synopsis	

Depending on the longevity of seeds during storage, seeds can be divided into two categories;

1. Orthodox Seeds: Orthodox seeds are long-lived seeds. They can be succe3ssfully dried to moisture contents as low as 5% without injury and are able to tolerate freezing temperatures. Most orthodox seeds come from annual temperate species adapted to open fields. At physiological maturity they contain moisture content of 30 – 50%.

2. Recalcitrant Seeds: They are short-lived seeds, which cannot be dried to moisture contents below 30% without injury and are unable to tolerate freezing.

They are difficult to store successfully because of their high moisture content encourages microbial contamination and results in more rapid seed deterioration.

Storage of these seeds at subzero temperatures causes the formation of ice crystals, which disrupts cell membranes and causes freezing injury.

These seeds are from perennial trees in the moist tropics such as coconut, coffee, cacao, citrus etc. These seeds mature and exists in their fruits and are covered with fleshy or juicy ariloid layers and impermeable testa.

At physiological maturity they contain more moisture content (50-70%) than orthodox seeds, even though their embryos are only about 15 % of the size of an orthodox seed embryo.

In general recalcitrant seeds never go into dormancy but instead continue their development and progress towards germination.

Most attempts at storing these seeds have focussed on using endogenous seed inhibitors such as absisic acid or replacing the high water content with other substances such as sugar or ethylene glycol to permit successful storage even under low temperature without inducing ice-crystal formation and subsequent seed damage.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Factors affecting longevity in storage; storage conditions, methods and containers
Hours Required	
Learning Objectives	Identify the seed borne pathogens and prescribe methods to prevent or control them. Evaluate various methods to produce healthy seeds
Previous Knowledge to be reminded	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity after teaching	Student interaction.
Activities outside the class	Student instructed to visit a nearer godown
Any other activity	NIL
Synopsis	

Factors influencing the life span of seeds:

1. **Genetic factors** : Seeds of some species are genetically and chemically equipped for lon storability than other under comparable conditions. Most long-lived seeds belong to speci possessing hard, impermeable seed coat.

2. Initial seed Quality: The physical condition and physiological state of seeds greatly influence their life span. Seeds that have been broken, cracked deteriorate more rapidly th undamaged seeds. Several kinds of environmental stresses during seed development and prior to physiological maturity can reduce the longevity of seeds. For example deficiency o minerals (N,K,Ca), water and temperature extremes. Immature small seeds within a seed l do not store as well as mature and large seeds within a seed lot. Hard seediness also exten seed longevity.

3. Seed Moisture: Moisture content of the seed is one of the important factors influencing viability of seed during storage. Over the moisture range, the rate of deterioration increase with increase in moisture. At very low moisture content of 4 per cent seeds may be damag due to extreme desiccation, or breakdown of membrane structure hastens deterioration

4. Relative humidity and Temperature:

the most important factors that influence the life span of seeds are relative humidity and temperature. The effects of R.H. and temperature of the storage environment are highly interdependent. The thumb rule applies when the seed moisture is in-between 4 and 14 %

5. Provenance: It has already been stated that a number of factors operating before and during harvest can affect seed viability. The samples obtained from different sources may show differences in viability behavior.

6. Pre and post harvest conditions: Environmental variations effect on the viability of seeds, unless the ripening process is interrupted by premature harvesting, weathering of maturing seeds in the field, particularly in conditions of excess moisture or freezing temperature results in a product with inferior storage potential.

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Name of theDepartment/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Definition of seed vigour, viability and longevity
Hours Required	2
Learning Objectives	Understand concepts of seed vigour, viability and longevity
Previous Knowledge to be reminded	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	BLACK BOARD, CHARTS AND LAPTOP
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity P after teaching	QUIZ, SEMINARS, SLIP TESTS
Activities outside the class	FIELD VISIT TO OBSERVE BACTERIAL DISEASE IN CROPS.
Any other activity	NIL
Synopsis	

Seed vigor

Seed vigour is defined as "the Sum total of those properties of the seed which determine the level of activity and performance of the seed or seed lot during germination and seedling emergence".

In any seed lot, losses of seed vigour are related to a reduction in the ability of seeds to carry out all the physiological functions that allow them to perform.

This process, called physiological ageing (or deterioration), starts before harvest and continues during harvest, processing and storageThese biochemical changes can occur very quickly (a few days) or more slowly (years), depending on genetic, production and environmental factors which are not yet fully understood.

The end point of this deterioration is ultimately death of the seed (i. e. complete loss of germination). However, seeds lose vigour before they lose the ability to germinate.

That is why seed lots that have similar high germination values can differ in their physiological age (the extent of deterioration) and so differ in seed vigour and therefore the ability to perform.

These seed vigour differences exist in seed lots of agricultural, horticultural and silvicultural species (ISTA, 2009).

Seed viability

Seed viability is the ability of the embryo to germinate, and is affected by a number of different conditions. A variety of factors can affect seed viability such as the ability of the plant to produce viable seeds, predator and pathogen damage, and environmental conditions like flooding or heat. The age of the seed also affects its health and germination ability.

The amount of time a seed remains viable can be influenced by both genetics and environment. Some seeds can remain viable under optimal conditions for many years, and others for only a season cycle.

Seed viability is of particular importance to industries such as forestry and agriculture, as they rely on germinating seedsIn this lab we will apply two methods of predicting seed viability. The first is based on a visual inspection of seed quality, and the second method uses the germination of a sample population of seeds to predict viability.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Seed sampling and equipment.
Hours Required	02
Learning Objectives	To learn Seed sampling and equipment
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Handful samples
Additional Inputs	nil
Teaching Aids Used	BLACK BOARD, LAPTOP, CHART
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity P after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
Activities outside the class	Industrial visit
Any other activity	NIL
Synopsis	

Seed sampling Objectives:

To obtain a sample of a size suitable for tests, in which the probability of a constituent being present is determined by its level of occurrence in the seed lot.

Seed Lot : Specified quantity of seed physically identifiable and homogenous from which a representative sample can be taken Sample Definite quantity that is a true representative of seed lot taken for testing - components are same as that of seed lot.

Criteria for Seed Lot:

1. It must be homogenous.
2. Of same variety, same season, same producer.
3. Moisture must be homogenous.
4. Must be found in same place.
5. Must be kept in similar containers.
6. Must be accessible for sampling.
7.

Sampling instruction: Person taking sample has to get permission from the owner of the lot in writing Take three representative samples.

One sample - sent to the seed testing lab,
Second one - handed over to the owner after getting due acknowledgement
Third one - retained with the person responsible for sampling.

Types of sample

(i) Primary sample Sample drawn from the lot at random first handful of sample if done manually, trier full of sample if done using trier.

(ii) (ii) Composite sample The primary samples are thoroughly mixed and combined to form composite sample.

(iii) (iii) Submitted sample Sample submitted to the Seed Testing Lab – Obtained from composite sample.

(iv) (iv) Working sample Obtained from submitted sample after through mixing and dividing - used to conduct tests like germination and purity.

Sampling methods:
Seeds lots are generally composed of free flowing seeds like wheat, rice, legumes etc. but some lots like those of cotton, grasses, tomato and carrot have seeds that are non-free flowing.

Based on this criterion, the sampling methods differ.

Hand sampling: Hand sampling is done in case of non-free flowing seeds.

Mechanical sampling: Mechanical sampling is done using triers. Triers are long, hollow tubes with pointed end that can hold seeds.

Automatic sampling: Processing machines have automatic sample collectors that regularly collect sample while seeds are being processed.

Sampling intensity: Sampling intensity is total number of primary samples that should be taken from a lot / containers. The primary sample should be of equal quantity. Sampling intensity differs between bulk seed lot and those that are packed in containers.

Sampling equipments:

Sampling is done using triers like nobbe trier, stick or sleeve trier or bin triers for bulk seeds

(i) bag snaking: A number of bags maybe emptied by pulling the open bag backwards over the floor surface, allowing a small stream of grain to flow out gradually. Most visible insects will be concentrated in the latter portion and will be readily observed at the sides of the band.

(ii) (ii) coning and quartering: Simple and cheap method of obtaining highly representative samples But suffers from time and capacity constraints.

(iii) (iii) sieving: "Hand held sieves" are useful in assessing the dust content and live insects from small samples. Different-sized mesh openings can be used for different particle size, or a combination of appropriate sizes can be used for mixed commodities varying in particle size.

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Name of theDepartment/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Physical purity analysis.
Hours Required	02
Learning Objectives	To learn Physical purity analysis.
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Husk, dust, stones, debris
Additional Inputs	Seeds with contaminations.
Teaching Aids Used	Charts, Black board, laptop, projector.
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity P after teaching	Interaction, Quiz, Student seminars & Slip test.
Activities outside the class	Nil
Any other activity	Nil
Synopsis	

Physical Purity Testing

Physical purity analysis tells us the proportion of pure seed component in the seed lot as well as the proportion of other crop seed, weed seed and inert matter by weight in percentage for which Seed Standards have been prescribed. Thus, it helps in:

i. Improving the plant stand (by increasing the pure seed component).

ii.Raising a pure crop (by eliminating other crop seed and weed seeds).

iii. Raising a disease free-crop (by eliminating inert matter).

iv. In the use of seed drill (by selecting uniform particles).

There is a need for physical purity analysis for:

a) Seed Certification or Seed Law Enforcement Agencies to judge that the seed lot.

b) Seed processing plants for using right kind of processing equipment.

c) Physical purity analysis is a pre-requisite for germination test because 'pure seed' component is used for germination testing.

Objective

The primary objective of physical purity analysis is to determine

i) the percentage composition by weight of the sample being tested and by inference the composition of seed lot

ii) The identity of various species of seeds and inert particles constituting the sample.

The definition of the various physical purity components in the ISTA Rules are as follows:

Pure Seed

The pure seed shall refer to the species stated by the sender, or found to Predominate the test, and shall include all botanical varieties and cultivars of that species (even if immature, undersized shriveled disease or germinated providing.

Other Crop Seed

Other crop seed shall include seed units of any plant species other than of pure seed grown as crops. Multiple structures, capsules, pods are opened and the seeds are taken out and the non-seed material is placed in the inert matter.

Weed Seeds

Seeds bulblets or tuber of plants recognized by laws, official regulations or by general usage shall be considered as weed seeds.

Inert matter

Inert matter shall include seed units and all other matter and structures not defined as pure seed excluding other crop seed and weed seeds.

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Name of theDepartment/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Seed moisture, methods of moisture determination.
Hours Required	03
Learning Objectives	To learn Seed moisture – importance
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity after teaching	Go to rice fields to observe blast disease of rice.
Activities outside the class	Students asked to recognize citrus canker.
Any other activity	nil
Synopsis	

Is the most important attribute, influencing seed quality and storability
Its estimation in seed quality assessment is vital
Is expressed either on wet weight basis or dry weight basis
In Seed Testing, always expressed on wet weight basis
Can be determined either by using moisture meter(s) or hot air oven method

Importance: The seed moisture content is the most vital parameter which influence the seed quality and storage life of the seed. Viability decrease more rapidly at high moisture content because of mould growth, heating damage, ageing and increased insect image. Seed moisture content is also closely associated with several aspect of physiological seed quality. For example, it is related to seed maturity, optimum harvest time, mechanical damage, economics of artificial seed drying, seed longevity and pathogen infestation.

Methods of moisture determination in seed Moisture meter method:

Estimation as quick and convenient

- Estimation is approximate (not precise)
- Estimation is generally based on electric conductivity
- Meter(s) to be calibrated, for each species
- Only to be used if, the results are comparable with an oven method

Air oven method:

- Standard reference method
- Estimation is precise
- Seed moisture is removed by drying (under specified temperature for specific duration)
- Approved by ISTA

Weight of submitted sample

- 100 g for species that have to be ground
- 50 g for all other species
- Be submitted in polythene bags.

Equipments Moisture meter(s) of different types• Constant temperature oven• Containers/bottles of glass or stainless steel• Desiccators with silica gel• An adjustable mill/seed grinder• A small spoon• Sieves set of 0.5, 1.0 and 4.0 mm mesh and receptacle• Analytical balance• Heat resistant hand glove• A brush and steel brush• Working sample Determination in two replicate i.e. two independently drawn sample• Sample size depend on the diameter of the containers, if diameter• is ≤8 mm: 4-5 g is ≥8 mm: 10 g Sample be thoroughly mixed• Stir the sample with spoon or pour the sample back and forth between two similar containers• Exposure of sample to laboratory atmosphere be minimum i.e. ≤ 30 sec.•

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Name of theDepartment/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Seed germination standard germination test; TZ test to determine seed viability; seed health testing.
Hours Required	02
Learning Objectives	To learn skills related to various seed testing methods
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity after teaching	Interaction, quiz , student seminars
Activities outside the class	Field trip
Any other activity	Slip test
Synopsis	

TZ TEST

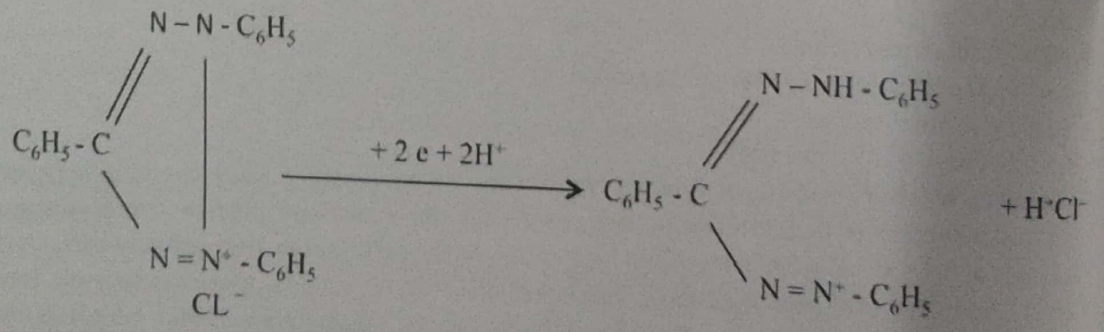
Tetrazolium (TZ) testing is a rapid method (can be finished within less than two days) for the evaluation of seed viability.

This method has been widely used by seed scientists to assess germination potentials, to determine the extent of seed damage, and to evaluate seed vigor and/or other seed lot problems.

The principle of TZ testing is based on the presence of dehydrogenase activity in viable seed tissues during the respiration process.

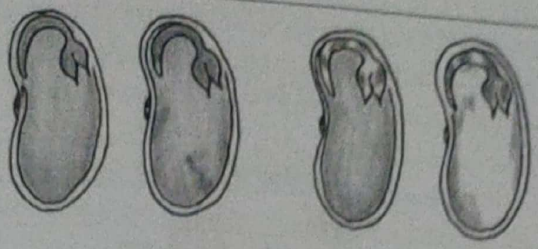
Dehydrogenase can catalyze the colorless 2,3,5 triphenyl tetrazolium chloride solution into red dye formazan.

Therefore, living tissues of seeds that imbibe tetrazolium chloride will be stained red, while dead tissues will retain their natural color.

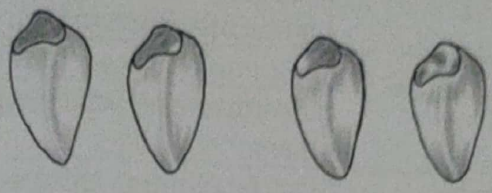


2,3,5-triphenyl tetrazolium chloride
(Colorless)

Formazan
(Red)



Phaseolus vulgaris (Bean)



Triticum aestivum (Wheat)

A standard TZ testing assay involves the following steps:

- **Preparation of dry seed**. The seed coats of many species are best to be treated by mechanical abrasion so that water or solutions can penetrate into the interior tissues of the seed.
- **Moistening**. This step aims to hydrate the seeds to activate the respiratory enzymes and to soften the tissues for cutting and piercing.
- **Preparation for staining**. Cut or pierce the seed to facilitate the absorbing of TZ solution by internal tissues.
- **Staining**. Soak the cut seeds in TZ solution for certain periods of time.
- **Evaluation of staining patterns**. Examine the seed for a color change in the embryo.

Lifeasible, as a global company specialized in plant biotechnology, offers innovative and reliable solutions for the evaluations of seed viability.

Our skilled seed scientists and experts have contributed decades of dedicated work for the exploration and optimization of seed viability test.

We proudly offer competitive short-turn-around and high-quality TZ testing service. Noticeably, we offer customized services to adapt to specific species and different research goals.

Our tailored protocols guarantee the optimal experimental conditions, including imbibition time, moistening time, cutting manner, TZ concentration, staining time and temperature, and so on.

We are devoted to providing our worldwide customers with our featured technologies, service plans, collaboration options and more.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	**Seed borne diseases:** A brief account of different seed borne diseases and their transmission.
Hours Required	03
Learning Objectives	Identify seed born pathogens and methods to control them.
Previous Knowledge to be reminded	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity after teaching	Interaction, quiz , student seminars
Activities outside the class	Field trip
Any other activity	Slip test
Synopsis	

There are six main types of organisms associated with seeds in storage. They are bacteria, fungi, mites, insects, rodents and birds.

Bacteria : Bacteria probably do not play a significant role in seed deterioration. As germination is rarely reduced unless infection has progressed beyond the point of decay. Since bacterial populations require free water to grow, they cannot grow in stored seeds as the seeds are dry.

Fungi: Two types of fungi invade the seeds; field fungi and storage fungi. The field fungi invade seeds during their development on plants in the field or following harvesting while the plants are standing in the field.they cannot invade seeds during storage. Field fungi associated with wheat or barley in the field are Alternaria, Fusarium, and Helminthosporium spp. Storage fungi, mostly belong to the genera Aspergillus and penicillium.
Major deleterious effects of storage fungi are to decrease viability, cause discoloration, produce mycotoxins, cause excessive heat and develop mustiness and caking.

Insects and Mites: Deterioration of seeds by insects and mites is a serious problem, particularly in warm and humid climates.
Weevils, flour beetles or borers are rarely activebelow 8% moisture content and 18-20 oC, but are increasingly destructive as the moisture content rises to 15% and the temperature to 30 – 35oC.

Mites do not thrive below 60% RH, although they have temperature tolerance that extents close
to freezing. Hence for protecting the seeds from insects and mites the seeds should be stored at a moisture content of less than 10%, at a temperature of less than 20oCand the R.H. of less than 60%.

Rodents and Birds: Birds are constant source of seed loss in even small openings exists. All openings should be sealed or screened, if needed for ventilation.
Rats and other rodents are more serious problems. Rodents may result into a complete loss of seed.
Rodents can be prevented from entering the store by elevating the floor by 90 cm above the ground level, and it should have a lip like structure of 15 cm around the building at 90 cm level.
A removable deck should be provided at the entrance for loading and unloading of seeds into the store.
9. Other factors: Besides the above factors storage life is affected by number of times and kind of fumigation, effect of seed treatment etc.

Seed Transmission of Pathogens

Seeds provide an efficient method for the transfer of plant pathogenic organisms between locations. More than 50% of the rnajor bean diseases are seed-borne.

As a farrner plants infested seed, he also sows the potential for future disease problems. Seed transmission of plant pathogens is of concern in Latin America beca use most farmers plant seed saved from previous harvests.

The effect of seed-borne organisms upon seed gerrnination is not well documented, but internally-bome fungi are associated with decreased seed gerrnination and field ernergence of dry beans found a correlation of -0.88 between percentage recovery of internally-bome fungi and seedling emergence.

Seed viability, gerrnination and contamination by rnicroorganisrns also can be affected by rnechanical damage which rnay occur during harvesting, threshing and /or planting.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Different seed health testing methods for detecting microorganisms.
Hours Required	03
Learning Objectives	Identify seed born pathogens and methods to control them.
Previous Knowledge to be reminded	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity after teaching	Interaction, quiz , student seminars
Activities outside the class	Field trip
Any other activity	Slip test
Synopsis	

Seed health :

Seed health concerns the overall condition of seeds. It includes pathogenic infection of seed insect infestation, morphological and physiological disorder, inert matter etc.

Seed health standard:

Seed health standard is the maximum acceptable limit of the presence of a given pathogen in a given seed lot. This is also referred to as "Pathogen tolerance level "or "Seed standard" for pathogen.

Field health standard:

Field health standard is the maximum acceptable limit of a given seed borne disease present in a given seed crop field. This is also referred as "Disease Tolerance level" or "Seed Standard"

Seed health testing: Seed health testing is a procedure by which can be determined whether tile seed is healthy or diseased or it is a procedure by which the presence of absence of seed borne pathogen(s) in a seed lot can be determined.

Objectives of Seed health testing

Seed health testing is necessary for the improvement of seed stock in certification scheme.

It is necessary to satisfy quarantine requirement of a country.

It is done to know the planting value of a given seed lot in order to forecast the field emergence and predict the health f the mature crop.

It is necessary to know the storage quality or feeding value of a seed lot.

It is necessary for checking the advisability of seed treatment. It is done to know the efficacy of seed treating chemicals

Basic requirements or considerations:

Routine methods for seed health testing must fulfill the following demands of efficiency and economy:

1. A test must give reliable information pertaining to field performance and quarantine requirements.
2. The results must be reproducible within the statistical limit
3. The time, labor and equipment for carrying through a test must be kept within economic limits.
4. The tests requiring incubation must be able to give the result quickly.

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Name of theDepartment/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Management of seed borne diseases; seed treatment methods: spraying and dusting.
Hours Required	02
Learning Objectives	Identify seed born pathogens and methods to control.
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity after teaching	Interaction, quiz , student seminars
Activities p outside the class	Field trip
Any other activity	Slip test
Synopsis	

Control of Seed-Borne Bacteria

It is reported that 95 species and varieties of bacteria may be seed-borne in numerous crops. Various bacteria! pathogens are reported to beinternally seed-borne in *Phaseolus vulgaris, Xanthomonas . phaseoli* and *Corynebacterium flaccumfaciens* can remain viable f or two to10 and five to 24 years, respectively, in seeds.

No satisfactory method of seed treatment will completely control intemally-bome bacteria of dry beans.

External seed contamination can be controlled by application of Streptomycin or Kasugamycin.

The most reliable method of producing seed free from bacterial pathogens is to select production areas where environmental conditions and cultural practices do not favor bacterial growth. At present, no commercial cultivar is immune to infection by the common blight pathogen. However, resistance to infection has been reported and differential pod susceptibility may be used to further reduce seed contamination.

Control of Seed-Borne Viruses

Viruses are reported to be seed-borne in *Phaseolus vulgaris*. Bean common mosaic virus is transmitted intemally in cotyledons and embryos but not in seed coats, while southem bean mosaic virus is transmitted in embryos and seed coats. Once seeds are infected, no seed treatmente available currently will eliminate the virus from bean seed. The most effective procedure is to produce clean seed in an area where the virus-infected plants can be eliminated and where vectors which transmit the virus can be controlled or do not exist. Development of resistant cultivars also will allow the production and use of clean seed. However, research still is needed to determine iflow levels of virus can pers.ist in resistant or tolerant cultivars and serve as reservoirs of inoculum for infection of susceptible cultivars by insects or other vectors.

Production of Pathogen-Free Seed

Clean seed production fields should be located in areas where the environment is unfavorable for survival, infection and spread of pathogenic organisms.

These production sites also should be located in regions where dry beans or other legumes are not grown commercially in order to avoid contamination by insect transmitted viruses with wide host ranges. A seed production program will require a form of inspection and certification to ensure seed cleanliness and purity.

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Name of theDepartment/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Indian seed Act; seed rules and seed order; new seed policy (1988).
Hours Required	02
Learning Objectives	To gain knowledge of seed policy (1988).
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity after teaching	Interaction, quiz , student seminars
Activities outside the class	Field trip
Any other activity	Slip test
Synopsis	

The Government of India evolved a New seed policy implemented from October 1,1988.

The policy laid special emphasis on

1. Import of high quality of seeds
2. A time bound programme to modernize plant quarantine facilities
3. Effective implementation of procedures for quarantine /post entry quarantine
4. Incentives to encourage the domestic industry
5. Import of quality seeds.
6. Bulk import of seeds of coarse cereals, pulses and oil seeds may replace (or) displace the local productions.

Transfer of technology may not be actual one, because due to bulk import of seeds or import of technology, instead we can import the germplasm of superior variety if any and could be developed locally to meet the demand (*i.e.*,) incorporate the advantages of exotic variety to the local types(or) even direct multiplication's after adaptive trials.

As we have superior varieties of international standard (e.g.) Maize, Sorghum, Bajra, or even in oil seeds like groundnut etc., the bulk import is not necessiated. Instead we need varieties suitable to agroclimatic zones besides higher yields.

Import of flower seeds could be encouraged in order to earn foreign exchange through export of flowers and it can be imported under (OGL) open general license. But there is a fear of introduction of new pest and diseases as they are coming without post entry quarantine checkup.

Strengthening of quarantine

Since, 1st October 1988 only bulk imports of seeds were under taken without any progress either in the strengthening of quarantine facilities.

Threat of pest and disease

Introduction of new pest and disease would pose a new problem due to bulk import due to lack of post entry quarantine. To avoid this threat, the imported seeds should be subjected to testing and it should be done by one person from ICAR. Entry of exotic variety without proper field testing may change the disease pattern if that particular strain is becoming susceptible to existing pathogens. (e.g.) Kernal bunt - which was not noticed in the previous years, is now a major disease on wheat after the introduction of Kalyansona.

Genetic erosion

It is another danger, due to introduction of similar strains there is a danger of genetic uniformity and eliminates local diversified strains which leads to problem of non-availability of improved strains if there is any out break of disease.

Incentives to domestic seed industry

Indigenous seed production / seed industry will be affected because of the entry of multination diseases. Since the policy is allowing indiscriminate bulk imports through private sectors at the same time the import duty on seeds has been reduced to 15 percent. Import duty on advanced machines and equipment used in seed production or processing has also been reduced and interest on post shipment credit has also been slashed down to help importers. Income tax rebate and deduction are available to the tax paying units on the revenue expenditure or in house research and development. Incentives are also being provided to seeds located in backward areas and growth centres.

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Name of theDepartment/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Seed Inspector: Duties and responsibilities;
Hours Required	01
Learning Objectives	To learn the Duties and responsibilities
Previous Knowledge to be reminded	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity after teaching	Interaction
Activities outside the class	FIELD VISIT
Any other activity	NIL
Synopsis	

Duties and powers of seed inspectors – offenses of Seed Act and penalties

Duties & Powers of seed inspector : - Sector IX Rule 23 specifics duties of seed inspector which may be summarized as follows.

1. He can draw representative samples of any kind / variety from any person selling such seed & send them analysis to the seed analyst.

2. To enter & search any place in which he believes that an offered under thus Act has been committed. He can order not to despise of any stock of such seed for specific period not exceeding 30 days.

3. To examine any record, register or document & seize them, if he feels that they can furnish evidence of an offered punishable under the Act.

4. On demand to pay the cost of seed calculated at the rate at which such seed is sold to the public.

5. He can break open the door & premises of seed seller if the seller refuses to open the door.

6. Search seize the stocks & records etc.

7. He can investigate any complaint made to him in writing.

8. He can investiture prosecutions in respect of breach of out & rules

9. Prohibit the sales of such seed which he fee ls are below the minimum limits of germination or improperly labeled & can initiate action against the sellers.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	classes of seeds, phases of certification standards
Hours Required	02
Learning Objectives	Learn classes of seeds, phases of certification standards
Previous Knowledge to be reminded	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity Planned after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
Activities planned outside the class	NIL
Any other activity	NIL
Synopsis	

Classes of seeds

1. **Breeder's seed:** Is a seed or vegetative propagating material which is directly controlled by sponsoring breeder of institution & which provides increases of foundation seeds.

2. **Foundation seed**: is a seed stock so as to maintain specific genetic identity and purity and may be designated or disturbed by agriculture experiment station. Production must be carefully supervised by representatives of the station. Foundation seed is the source of all other certified seed classes, either directly or through registered seed.

3. **Registered seed:** Registered seed is the progenies of foundation and it is handled so as to maintain genetic identity and purity and that has been approved by and certified by certifying agencies.

4. **Certified seed:** Is the progeny of foundation, registered or certified seed, that is handled to maintain genetic identity and purity and that has been approved by and certified by certifying agencies.

Seed Certification Procedure

Good quality seeds refer to seeds having optimum genetic and physical purity , high germination procedure percentage and seed with optimum moisture content.

It also includes seeds free from noxious weed seed and other crop seeds and free from seed borne diseases.

To meet these criteria there is a need of certification.

Seed Certification:
Seed certification is a legally sectioned system for quality control of seed during seed multiplication and production.

Seed certification is a scientific and systematically designed process to secure, maintain, multiply and make available seeds of notified and released varieties to the farmers.

Object of Seed Certification:

1) To ensure genetical identity of a variety.

2) To ensure high degree of physical purity.

3) To ensure high degree of germinability.

4) To ensure freedom from all designation seed borne disease, weeds and other crop seeds.

According to statutory rules and regulation of seed act (1966), autonomous government organization such as state seed certification Agency is established.

Procedures for registration, field inspection, seed processing, release sampling, seed testing , issue of seed certification tags and seals and release of seed lots are established.

Phases of Seed Certification:

1) Receipt and security of application with notarized agreement for registration of seed plot for certification.

2) Verification of seed source, class used for raising the crop by checking certification tags, lablels, seed containers , cash memo or bills.

3) Field inspections of the seed plot to verify conformity to prescribed field standards.

4) Post harvest supervision of seed crop including sealing raw seed , issue T.C . supervision during seed processing at registered seed processing plant.

5) Seed sampling and sending sample to STI for analysis to verify conformity to prescribed seed standards as well as genetic purity.

6) Grant of certification, tagging and sealing of the containers – Release of seed lot for seed multiplication or marketing for commercial.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BZC
Paper	**Seed Technology**
Name of the Topic	Issue of certificates, tags and sealing
Hours Required	02
Learning Objectives	To learn Issue of certificates, tags and sealing
Previous Knowledge to remind	Post fertilization changes in angiosperms
Examples/Illustrations	Seed coat, testa and tegmen
Additional Inputs	Seeds of different plants
Teaching Aids Used	Black board, Laptop
References Cited	DuPont, Tianna. "Seed and Seedling Biology."
Student Activity Planned after teaching	TO WRITE SLIP TEST AND TO GIVE A SEMINAR, QUIZ.
Activities planned outside the class	Field visit
Any other activity	
Synopsis	NIL

Certification shall be completed in six broad phases listed as under:
(a) receipt and scrutiny of application;

(b) verification of seed source, class and other requirements of the seed used for raising the seed crop;

(c) field inspections to verify conformity to the prescribed fielq standards;

d) supervision at post-harvest stages including processing and packing;

e) seed sampling and analysis, including genetic purity test and/or seed health test, if any, in order to verity conformity to the prescribed standards; and

(f) Grant of certificate and certification tags, tagging and sealing.

Retention of Certification Records:

The Certification Agency shall preserve in order all the documents including the guard samples pertaining to certification of each seed lot for two years from the date of grant/extension of the certificate and four years in respect of rejected seed crops or lots from the date of communication of rejection unless and otherwise required for longer period.

Seed Analysis-Report :

The Seed Testing Laboratory shall analyse the seed samples in accordance with the prescribed procedure and deliver the Seed Analysis Report to the Certification Agency as soon as may be, but not later than 30 days from the date of receipt of the samples unless the seed is subjected to such tests which require more than 30 days for completion of the test.

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VIDAVALUR, SPSR NELLORE – Dist., A.P.

(Accredited with B+ Grade by NAAC)

Estd. 1965

SC. SRINIVASULU

Lecturer in Commerce

DEPARTMENT OF COMMERCE

Teaching Notes

Semester – I, III & V

(2022-23)

Teaching Plan – ~~Business Statistics~~ Fundamentals of Accounting-I – I B.Com.,

e of the Topic	Introduction to Accounting
-s required	10
ning Objectives	Need for Accounting, meaning, Objectives, Book Keeping, Classification of Accounts
ous knowledge to be reminded	Yes
: Synopsis unting: Accounting has rightly been termed ie language of the business. The basic tion of a language is to serve as a ns of communication. Accounting communicates the result siness operations to various parties have some stake in the business. With elp of accounting records the business e to ascertain the profit or loss and the cial position of the business at the end iven period and communicate such nation to all interested parties. ves of Accounting: To keep systematic records. To ascertain the operational profit or loss	iii) To ascertain the financial position the business iv) To facilitate rational decision maki **Book Keeping:** Book-keeping and accounting are differ from each other. Book-keeping is mainly concerned with recording of financial data relating to business operations in a significant and orderly manner. Book-keeping invo the systematic recording of the finar transactions and the maintenance of correct & up-to-date financial records o organization. Accounting is primarily conce with designing the systems for recor classifying and summarizing the data interpreting them for internal and ext end users.
es/Illustrations	Given
nal inputs	Given
g Aids used	Black Board
ces cited	Books
	Group Discussion and

Commissionerate of Collegiate Education, A.P.

PRR & VS Government College, Vidavalur, SPSR Nellore Dist

Teaching Plan – ~~Business Statistics~~ Fundamentals of Accounting-I – I B.Com.,

lame of the Topic	Introduction to Accounting
lours required	10
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revious knowledge to be reminded	Yes
opic Synopsis ccounting: Accounting has rightly been termed is the language of the business. The basic function of a language is to serve as a neans of communication. Accounting communicates the result of business operations to various parties who have some stake in the business. With he help of accounting records the business s able to ascertain the profit or loss and the inancial position of the business at the end f a given period and communicate such nformation to all interested parties. jectives of Accounting: i) To keep systematic records. ii) To ascertain the operational profit or loss	iii) To ascertain the financial position of the business iv) To facilitate rational decision making Book Keeping: Book-keeping and accounting are different from each other. Book-keeping is mainly concerned with recording of financial data relating to the business operations in a significant and orderly manner. Book-keeping involves the systematic recording of the financial transactions and the maintenance of the correct & up-to-date financial records of the organization. Accounting is primarily concerned with designing the systems for recording, classifying and summarizing the data and interpreting them for internal and external end users.
amples/Illustrations	Given
ditional inputs	Given
aching Aids used	Black Board
erences cited	Books
dent Activity planned after the ching	Group Discussion and problems
...planned outside the Class room, if any	

Commissionerate of Collegiate Education, A.P.
& VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan – Business Statistics – I B.Com., Fundamentals of Accounting -I

f the Topic	Bank Reconciliation Statement
equired	10
g Objectives	Meaning and Need of BRS
s knowledge to be reminded	Yes
ynopsis g: Bank Reconciliation Statement is a ent prepared, periodically with a o enlist the reasons for difference n the balances as per the bank of the cashbook and pass ank statement on any given date. preparing Bank Reconciliation nt: Reconciliation Statement is a reconciling the balance as shown ank passbook and the balance as the Bank column of the Cashbook. tive of preparing such a statement the causes of difference between balances and to reconcile these	Causes of differences between Cash Book and Pass Book: i) Cheques issued by the Trader but not yet presented for payment ii) Cheques deposited into bank but not yet collected or credited by the Bank iii) Amount directly deposited by customers/debtors in the bank account iv) Bank charges charged by the Bank v) Interest and dividend received by the bank on behalf of the customer vi) Direct payments made by the bank on behalf of the customer vii) Dishonour of cheques deposited with bank viii) Errors committed in recording transactions by the firm
Illustrations	Given
inputs	Given
ids used	Black Board
cited	Books
tivity planned after the	Group Discussion and problems
ned outside the Class room, if any	

Directorate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan – Business Statistics – II B.Com.,

Name of the Topic	Introduction to Statistics
Hours required	10
Learning Objectives	Definition, importance and Limitations of Statistics, Schedule and Questionnaire
Previous knowledge to be reminded	Yes
Topic Synopsis ntroduction: For a layman, 'Statistics' means numerical information expressed in quantitative terms. This information may relate to objects, subjects, activities, phenomena, or regions of space. efinition: A.L. Bowley has defined statistics as: (i) atistics is the science of counting, (ii) atistics may rightly be called the science of erages, and (iii) statistics is the ience of measurement of social organism garded as a whole in all its manifestations portance of statistics : w a days statistical methods and nciples are widely used in various fields knowledge. To business: Success of business depends n efficient management of production sales which in turn depend on location, , marketing and quality control.	(ii) To Government: Statistics help the government in envisaging various welfare programmes. **Limitations of Statistics** Statistics has a number of limitations, pertinent among them are as follows: (i) Statistics deals only with quantitative aspects of the problems (ii) Statistics deals with aggregate of facts (iii) Statistical results are true only on an average (iv) Statistics is only a means and not an end **Questionnaires:** Collection of data through questionnaires is an important and popular method. Under this method the data is collected with the help of particular form containing a number of questions which are designed to collect the necessary data relating to the object of the investigation.
mples/Illustrations	Given
litional inputs	Given
ching Aids used	Black Board
rences cited	Books
ent Activity planned after the ing	Group Discussion and problems
ity planned outside the Class room, if any	
other activity	

Commissionerate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan – Business Statistics – II B.Com.,

Name of the Topic	Measures of Central Tendency
Hours required	10
Learning Objectives	Characteristics of Measures of Central Tendency and Types of Averages
Previous knowledge to be reminded	Yes
Topic Synopsis Introduction: The measures of central tendency are the most popularly used tools to condense the mass data and represent it through single numbers. It enables us to compare two or more distributions pertaining to the same time period or within the same distribution over time. Average: One of the important and essential measures of summarizing the data in statistical analysis is average. Average is the method of reducing the mass and complex data into a single representative numerical figure. Types of Averages. Arithmetic Mean Median Mode Geometric Mean Harmonic Mean	ARITHMETIC MEAN Adding all the observations and dividing the sum by the number of observations results the arithmetic mean. MEDIAN Median is defined as the value of the middle item (or the mean of the values of the two middle items) when the data are arranged in an ascending or descending order of magnitude. MODE It is the value at the point around which the items are most heavily concentrated.
Examples/Illustrations	Given
Additional inputs	Given
Teaching Aids used	Black Board
References cited	Books
Student Activity planned after the teaching	Group Discussion and problems
Activity planned outside the Class room, if any	
Any other activity	

Principal

Commissionerate of Collegiate Education, A.P.
& VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan –Cost Accounting – III B.Com.,

f the Topic	Introduction to Cost Accounting
equired	10
g Objectives	Meaning of Cost Accounting, Different concepts of Cost Accounting
knowledge to be reminded	Yes – Cost sheet preparation
nopsis ounting: mpared to the financial accounting, cus of cost accounting is different. utation of cost on scientific basis ereafter cost control and cost ion has become of paramount tance. st can be defined as the enditure (actual or notional) rred on or attributable to a given . Costing: may be defined as 'the technique cess of ascertaining costs'. nting: counting primarily deals with n, analysis of relevant of cost interpretation and presentation us problems of management.	**Difference between Cost Accounting and Financial Accounting:** **Financial Accounting** / **Cost Accounting** It aims at finding out results of accounting year in the form of P&L Account and Balance Sheet. / It aims at computing cost of production/service in a scientific manner and then cost control and cost reduction. Financial Accounting data is historical in nature / It not only deals with historical data but is also futuristic in approach. It aims at presenting 'true and fair' view of the profit and loss position as well as financial position. / It aims at computing 'true and fair' view of the cost of production/services offered by the firm.
llustrations	Given
nputs	Given
ds used	Black Board
ited	Books
vity planned after the	Group Discussion and problems
ed outside the Class room, if any	
ivity	

Directorate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan –Cost Accounting – III B.Com.,

ame of the Topic	Job Costing
ours required	10
earning Objectives	Job Costing Features, Advantages and Limitations
revious knowledge to be reminded	Yes – Cost sheet preparation
opic Synopsis	

ob Costing:

his method of costing is used in Job Order ıdustries where the production is as per e requirements of the customer. In Job rder industries, the production is not on ntinuous basis, rather it is only when order om customers is received and that too as r the specifications of the customer.

atures of job costing:

i) It is a specific order costing.
ii) A job is carried out or a product is produced to meet the specific requirements of the order.
iii) Job costing enables a business to ascertain the cost of a job on the basis of which quotation for the job may be given.

Advantages of Job Costing:

i) Accurate information is available regarding the cost of the job completed and the profits generated from the same.
ii) Proper records are maintained regarding the material, labor and overheads so that a costing system is built up.
iii) Useful cost data is generated from the point of view of management for proper control and analysis.

Limitations of Job Costing

i) It is said that it is too time consuming and requires detailed record keeping. This makes the method more expensive.
ii) Record keeping for different jobs may prove complicated

amples/Illustrations	Given
ditional inputs	Given
aching Aids used	Black Board
erences cited	Books
dent Activity planned after the hing	Group Discussion and problems
vity planned outside the Class room, if any	
other activity	

R & VS Government College, Vidavalur, SPSR Nellore Dist
State Education, A.P.

Teaching Plan – Cost Accounting – III B.Com.,

of the Topic	Marginal Costing
: required	10
ing Objectives	Meaning of Marginal Costing, Features and BEP Analysis
ous knowledge to be reminded	Yes
Synopsis luction: Marginal Costing is not a ethod of costing like job, or contract osting. It is in fact a technique of osting in which only variable anufacturing costs are considered hile determining the cost of goods sold d also for valuation of inventories. tion: ginal Cost is defined as, 'the change in ite costs due to change in the volume uction by one unit'. Marginal Costing has been defined ertainment of cost and measuring the on profits of the change in the of output or type of output. of Marginal Costing marginal costing, costs are gregated into fixed and variable. nly variable costs are charged to the oduction.	2. Another important feature of marginal costing is the valuation of inventory is done at variable cost only. **Break Even Point:** The Break Even Point is a level of production where the total costs are equal to the total revenue, i.e. sales. Thus at the break even level, there is neither profit nor loss. Production level below the break-even-point will result into loss while production above break-even point will result in profits. Break Even point [in units] = Fixed Cost / Contribution per Unit Break even point [in Rs.] = Fixed Cost / Profit Volume [P/V] Ratio
/Illustrations	Given
l inputs	Given
Aids used	Black Board
cited	Books
tivity planned after the	Group Discussion and problems

PRR & VS GOVERNMENT DEGREE COLLEGE

VIDAVALUR, SPSR NELLORE – Dist., A.P.

(Accredited with B+ Grade by NAAC)

Estd. 1965

SC. SRINIVASULU

Lecturer in Commerce

DEPARTMENT OF COMMERCE

Teaching Notes

Semester – II, IV & VI

(2022-23)

R & VS Government College, Vidavalur, SPSR Nellore
Teaching Plan – ~~Business Statistics~~ Fundamentals of Accounting-I – I B.Com.,

e of the Topic	Introduction to Accounting
s required	10
ning Objectives	Need for Accounting, meaning, Objectives, Book Keeping, Classification of Accounts
ous knowledge to be reminded	Yes
e Synopsis unting: Accounting has rightly been termed he language of the business. The basic ction of a language is to serve as a ns of communication. Accounting communicates the result usiness operations to various parties have some stake in the business. With help of accounting records the business ble to ascertain the profit or loss and the ncial position of the business at the end given period and communicate such rmation to all interested parties. ctives of Accounting: To keep systematic records.) To ascertain the operational profit or loss iii) To ascertain the financial position the business iv) To facilitate rational decision maki Book Keeping: Book-keeping and accounting are differ from each other. Book-keeping is mainly concerned with recording of financial data relating to business operations in a significant and orderly manner. Book-keeping invo the systematic recording of the finar transactions and the maintenance of correct & up-to-date financial records of organization. Accounting is primarily conce with designing the systems for recor classifying and summarizing the data interpreting them for internal and ext end users.	
ples/Illustrations	Given
ional inputs	Given
ing Aids used	Black Board
ences cited	Books
t Activity planned after the	Group Discussion and problems

Commissionerate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan – ~~Business Statistics~~ Fundamentals of Accounting-I – I B.Com.,

ame of the Topic	Introduction to Accounting
ours required	10
earning Objectives	Need for Accounting, meaning, Objectives, Book Keeping, Classification of Accounts
revious knowledge to be reminded	Yes
opic Synopsis ccounting: Accounting has rightly been termed as the language of the business. The basic function of a language is to serve as a means of communication. Accounting communicates the result of business operations to various parties who have some stake in the business. With the help of accounting records the business is able to ascertain the profit or loss and the financial position of the business at the end of a given period and communicate such information to all interested parties. bjectives of Accounting: i) To keep systematic records. ii) To ascertain the operational profit or loss	iii) To ascertain the financial position of the business iv) To facilitate rational decision making Book Keeping: Book-keeping and accounting are different from each other. Book-keeping is mainly concerned with recording of financial data relating to the business operations in a significant and orderly manner. Book-keeping involves the systematic recording of the financial transactions and the maintenance of the correct & up-to-date financial records of the organization. Accounting is primarily concerned with designing the systems for recording, classifying and summarizing the data and interpreting them for internal and external end users.
amples/Illustrations	Given
ldditional inputs	Given
aching Aids used	Black Board
ferences cited	Books
udent Activity planned after the aching	Group Discussion and problems
tivity planned outside the Class room, if any	

Commissionerate of Collegiate Education, A.P.
R & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan – Business Statistics – I B.Com., Fundamentals of Accounting-I

of the Topic	Bank Reconciliation Statement
: required	10
ing Objectives	Meaning and Need of BRS
ous knowledge to be reminded	Yes
Synopsis ing: Bank Reconciliation Statement is a ment prepared, periodically with a to enlist the reasons for difference een the balances as per the bank nn of the cashbook and pass /bank statement on any given date. of preparing Bank Reconciliation ent: ık Reconciliation Statement is a nt reconciling the balance as shown bank passbook and the balance as by the Bank column of the Cashbook. ective of preparing such a statement ow the causes of difference between balances and to reconcile these ces	Causes of differences between Cash Book and Pass Book: i) Cheques issued by the Trader but not yet presented for payment ii) Cheques deposited into bank but not yet collected or credited by the Bank iii) Amount directly deposited by customers/debtors in the bank account iv) Bank charges charged by the Bank v) Interest and dividend received by the bank on behalf of the customer vi) Direct payments made by the bank on behalf of the customer vii) Dishonour of cheques deposited with bank viii) Errors committed in recording transactions by the firm
es/Illustrations	Given
ıal inputs	Given
g Aids used	Black Board
es cited	Books
Activity planned after the	Group Discussion and problems
planned outside the Class room, if any	

Directorate of Collegiate Education, A.P.

PRR & VS Government College, Vidavalur, SPSR Nellore Dist

Teaching Plan – Business Statistics – II B.Com.,

Name of the Topic	Introduction to Statistics
Hours required	10
Learning Objectives	Definition, importance and Limitations of Statistics, Schedule and Questionnaire
Previous knowledge to be reminded	Yes
Topic Synopsis Introduction: For a layman, 'Statistics' means numerical information expressed in quantitative terms. This information may relate to objects, subjects, activities, phenomena, or regions of space. Definition: A.L. Bowley has defined statistics as: (i) tatistics is the science of counting, (ii) Statistics may rightly be called the science of verages, and (iii) statistics is the cience of measurement of social organism egarded as a whole in all its manifestations mportance of statistics : low a days statistical methods and rinciples are widely used in various fields f knowledge.) To business: Success of business depends on efficient management of production nd sales which in turn depend on location, e, marketing and quality control.	(ii) To Government: Statistics help the government in envisaging various welfare programmes. **Limitations of Statistics** Statistics has a number of limitations, pertinent among them are as follows: (i) Statistics deals only with quantitative aspects of the problems (ii) Statistics deals with aggregate of facts (iii) Statistical results are true only on an average (iv) Statistics is only a means and not an end **Questionnaires:** Collection of data through questionnaires is an important and popular method. Under this method the data is collected with the help of particular form containing a number of questions which are designed to collect the necessary data relating to the object of the investigation.
xamples/Illustrations	Given
dditional inputs	Given
eaching Aids used	Black Board
ferences cited	Books
ident Activity planned after the ching	Group Discussion and problems
ivity planned outside the Class room, if any	
y other activity	

Commissionerate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan – Business Statistics – II B.Com.,

Name of the Topic	Measures of Central Tendency
Hours required	10
Learning Objectives	Characteristics of Measures of Central Tendency and Types of Averages
Previous knowledge to be reminded	Yes
Topic Synopsis Introduction: The measures of central tendency are the most popularly used tools to condense the mass data and represent it through single numbers. It enables us to compare two or more distributions pertaining to the same time period or within the same distribution over time. Average: One of the important and essential measures of summarizing the data in statistical analysis is average. Average is the method of reducing the mass and complex data into a single representative numerical figure. Types of Averages. Arithmetic Mean Median Mode Geometric Mean Harmonic Mean	ARITHMETIC MEAN Adding all the observations and dividing the sum by the number of observations results the arithmetic mean. MEDIAN Median is defined as the value of the middle item (or the mean of the values of the two middle items) when the data are arranged in an ascending or descending order of magnitude. MODE It is the value at the point around which the items are most heavily concentrated.
Examples/Illustrations	Given
Additional inputs	Given
Teaching Aids used	Black Board
References cited	Books
Student Activity planned after the teaching	Group Discussion and problems
Activity planned outside the Class room, if any	
Any other activity	

Principal

Commissionerate of Collegiate Education, A.P.
& VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan –Cost Accounting – III B.Com.,

<table>
<tr><td>f the Topic</td><td>Introduction to Cost Accounting</td></tr>
<tr><td>equired</td><td>10</td></tr>
<tr><td>g Objectives</td><td>Meaning of Cost Accounting, Different concepts of Cost Accounting</td></tr>
<tr><td>s knowledge to be reminded</td><td>Yes – Cost sheet preparation</td></tr>
<tr><td>ynopsis
counting:
ompared to the financial accounting, ocus of cost accounting is different.
putation of cost on scientific basis hereafter cost control and cost ction has become of paramount rtance.
ost can be defined as the penditure (actual or notional) urred on or attributable to a given g. Costing:
g may be defined as 'the technique rocess of ascertaining costs'.

ounting:
ccounting primarily deals with ion, analysis of relevant of cost r interpretation and presentation ious problems of management.</td><td>Difference between Cost Accounting and Financial Accounting:

<table><tr><th>Financial Accounting</th><th>Cost Accounting</th></tr><tr><td>It aims at finding out results of accounting year in the form of P&L Account and Balance Sheet.</td><td>It aims at computing cost of production/service in a scientific manner and then cost control and cost reduction.</td></tr><tr><td>Financial Accounting data is historical in nature</td><td>It not only deals with historical data but is also futuristic in approach.</td></tr><tr><td>It aims at presenting 'true and fair' view of the profit and loss position as well as financial position.</td><td>It aims at computing 'true and fair' view of the cost of production/services offered by the firm.</td></tr></table></td></tr>
<tr><td>Illustrations</td><td>Given</td></tr>
<tr><td>inputs</td><td>Given</td></tr>
<tr><td>Aids used</td><td>Black Board</td></tr>
<tr><td>cited</td><td>Books</td></tr>
<tr><td>tivity planned after the</td><td>Group Discussion and problems</td></tr>
<tr><td>ined outside the Class room, if any</td><td></td></tr>
<tr><td>ctivity</td><td></td></tr>
</table>

...torate of Collegiate Education, A.P.
...RR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan –Cost Accounting – III B.Com.,

...me of the Topic	Job Costing
...ours required	10
...earning Objectives	Job Costing Features, Advantages and Limitations
...revious knowledge to be reminded	Yes – Cost sheet preparation
...opic Synopsis ...ob Costing: ...his method of costing is used in Job Order ...dustries where the production is as per ...e requirements of the customer. In Job ...rder industries, the production is not on ...ntinuous basis, rather it is only when order ...om customers is received and that too as ...er the specifications of the customer. ...eatures of job costing: i) It is a specific order costing. ii) A job is carried out or a product is produced to meet the specific requirements of the order. iii) Job costing enables a business to ascertain the cost of a job on the basis of which quotation for the job may be given.	Advantages of Job Costing: i) Accurate information is available regarding the cost of the job completed and the profits generated from the same. ii) Proper records are maintained regarding the material, labor and overheads so that a costing system is built up. iii) Useful cost data is generated from the point of view of management for proper control and analysis. Limitations of Job Costing i) It is said that it is too time consuming and requires detailed record keeping. This makes the method more expensive. ii) Record keeping for different jobs may prove complicated
...amples/Illustrations	Given
...ditional inputs	Given
...aching Aids used	Black Board
...ferences cited	Books
...dent Activity planned after the ...ching	Group Discussion and problems
...vity planned outside the Class room, if any	
...other activity	

B. S

PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan – Cost Accounting – III B.Com.,

me of the Topic	Marginal Costing
urs required	10
rning Objectives	Meaning of Marginal Costing, Features and BEP Analysis
vious knowledge to be reminded	Yes
ic Synopsis oduction: Marginal Costing is not a method of costing like job, or contract costing. It is in fact a technique of costing in which only variable manufacturing costs are considered while determining the cost of goods sold and also for valuation of inventories. nition: rginal Cost is defined as, 'the change in gate costs due to change in the volume duction by one unit'. Marginal Costing has been defined certainment of cost and measuring the on profits of the change in the of output or type of output. es of Marginal Costing In marginal costing, costs are segregated into fixed and variable. Only variable costs are charged to the roduction.	2. Another important feature of marginal costing is the valuation of inventory is done at variable cost only. **Break Even Point:** The Break Even Point is a level of production where the total costs are equal to the total revenue, i.e. sales. Thus at the break even level, there is neither profit nor loss. Production level below the break-even-point will result into loss while production above break-even point will result in profits. Break Even point [in units] = Fixed Cost / Contribution per Unit Break even point [in Rs.] = Fixed Cost / Profit Volume [P/V] Ratio
es/Illustrations	Given
al inputs	Given
Aids used	Black Board
s cited	Books
ctivity planned after the	Group Discussion and problems

Teaching Note 2022-2023

Commissionerate of Collegiate Education, A.P.,

Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 3	
Name of the Topic	Cell biology
Hours required	16
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the prokaryoyes, eukaryotes, golgli complex, E.R, lysosomes, tc was discussed.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. A.P. Academy Book 2. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

PRINCIPAL
PBR & VS GOVT. COLLEGE
VIDAVALUR - 524318
SPSR NELLORE DT

Commissionerate of Collegiate Education, A.P.,

Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 3	
Name of the Topic	Introduction about the Cell biology and cell organelles of animal
Hours required	12
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the Cell biology and cell organelles of animal like Plasma membrane, mitochondira, ribosomes was discussed.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. Cell Biology by C.B. Power 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

PRINCIPAL
PBR & VS GOVT. COLLEGE
VIDAVALUR - 524313
SPSR NELLORE DT

Commissionerate of Collegiate Education, A.P.,

Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 3	
Name of the Topic	Cell biology
Hours required	4
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about thePlasma membrane , its structure, functions, Models of PM like Unit membrane model, Fluid mosic model, lattice model, Bilaminar model was discussed.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. Cell Biology by C.B. Power 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

PRINCIPAL
PBR & VS GOVT. COLLEGE
VIDAVALUR - 524318
SPSR NELLORE DT

Commissionerate of Collegiate Education, A.P.,

Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 3	
Name of the Topic	Chromosomes
Hours required	6
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the chromosomes, types and importance of chromosomes etc was discussed.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. Cell Biology by C.B. Power 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

PRINCIPAL
PRR & VS GOVT. COLLEGE
VIDAVALUR - 524318
SPSR NELLORE DT

Commissionerate of Collegiate Education, A.P.,

Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 3	
Name of the Topic	Chromosomes
Hours required	6
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the chromosomes, types and importance of chromosomes etc was discussed.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. Cell Biology by C.B. Power 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
	None

Commissionerate of Collegiate Education, A.P.,

Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : I	
Name of the Topic	The introduction about the Zoology and Introduction of Protozoa, Classification,
Hours required	4
Learning Objectives	Yes
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the Zoology and Introduction about the Invertebrates, Protozoa introduction, Classification of protozoa.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, black board, and giving the Handouts about the topic
References Cited	1. The Invertebrates Book by Kotpal Verma 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

PRINCIPAL
PBR & VS GOVT. COLLEGE
VIDAVALUR - 524316
SPSR NELLORE DT

Commissionerate of Collegiate Education, A.P.,

Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : I	
Name of the Topic	The Phylum Porifera and Type study Sycon
Hours required	4
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the Porifera, Classification of porifera, Type study Sycon was explained, its morphology and Canal system like Ascon, Sycon, Leucon was discused.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. The Invertebrates Book by Kotpal Verma 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

PRINCIPAL
PBR & VS GOVT. COLLEGE
VIDAVALUR - 524316
SPSR NELLORE DT

Commissionerate of Collegiate Education, A.P.,

Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : I	
Name of the Topic	The Phylum Coelenterata and Type study Obelia
Hours required	16
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the Coelenterata, Classification of Coelenterata and Polymorphisim in Coelenterata like Dactylozoids, Phyllozoids, Gonophores etc discused. Corals and coral reefs.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. The Invertebrates Book by Kotpal Verma 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : I	
Name of the Topic	The Phylum Platyhelminthes and Type study Fasiola hepatica
Hours required	4
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the Platyhelminthes, Classification of Platyhelminthes, Type study Fasiola hepatica was explained, its morphology, structure, reproduction types, excretion, and Life Cycle of Fasiola hepatica in sheep and larval forms like miracidium, redia, cercaria and metacercaria etc discused.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. The Invertebrates Book by Kotpal Verma 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : I	
Name of the Topic	The Phylum Nematyhelminthes and Type study Ascaris
Hours required	2
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the Nematyhelminthes, Classification of Platyhelminthes, Type study Ascaris was explained, its morphology, structure, reproduction types, excretion, and Life Cycle of Ascaris in sail and etc discused.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. The Invertebrates Book by Kotpal Verma 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : I	
Name of the Topic	The Phylum Annelida and Classification
Hours required	4
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the Annelida and classification of annelid was discussed. The Class like
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. The Invertebrates Book by Kotpal Verma 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : I	
Name of the Topic	The Phylum Arthropoda and Classification
Hours required	4
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the Arthropoda and classification, Peripatus was discussed. The Class like
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. The Invertebrates Book by Kotpal Verma 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 2	
Name of the Topic	Prtochordata
Hours required	8
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the chordate and protochordata, life history of herdmania, retrogressive metamorphosis etc was discussed.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. A.P. Academy Book 2. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 2	
Name of the Topic	Cyclostomata
Hours required	6
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Cyclostomata, General characters, Comparison ofPetromyzon and Myxine, migration, types of scales and dipnoi fishes
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. A.P. Academy Book 2. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 2	
Name of the Topic	Amphibia and Reptiles
Hours required	20
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	General characters of Amphibia, reptiles and classification of amphbia and reptiles. Identification of poisonous and non poisonous snakes are discussed
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. A.P. Academy Book 2. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 2	
Name of the Topic	Aves
Hours required	10
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Aves GC and classification, respiration migration and flight adaptations etc was discussed.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. Cell Biology by C.B. Power 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

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Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : 2	
Name of the Topic	Mammals
Hours required	12
Learning Objectives	
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Mammals GC and classification, Protheria, metatheria and eutheria, Dentition etc was discussed.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. Cell Biology by C.B. Power 2. A.P. Academy Book 3. Source from Internet
Student Activity Planned after the teaching	--
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : V	
Name of the Topic	The introduction about the Zoology and Introduction of Aquaculture was given.
Hours required	14
Learning Objectives	What means zoology and what the aquaculture like the cultivation of fishes, prawns, fish gears, nets and induced breeding etc
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the Zoology and Introduction about the aquaculture the cultivation of fishes, prawns, etc., was discussed
Examples/Illustrations	---
Additional inputs	None
Teaching Aids used	Chalk piece, black board, and giving the Handouts about the topic
References Cited	1. A.P. Academ...

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- Elglish Medium	
Paper : V	
Name of the Topic	The introduction about the fish clening, spoilage etc.
Hours required	2
Learning Objectives	Through the Internet and from the Books
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Introduction about the the cultivation of Fishes and edible fishes. The catla catla, cirhinus, milk fishes, rohu and lobeo etc was discussed.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, black board, and giving the Handouts about the topic
References Cited	1. A.P. Academy Book 2. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : V	
Name of the Topic	Fish preservation –.
Hours required	6
Learning Objectives	Through the Internet and from the Books
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Fish cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	4. A.P. Academy Book 5. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : V	
Name of the Topic	Traditional methods
Hours required	2
Learning Objectives	Through the Internet and from the Books
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Traditional methods - sun drying, salt curing, pickling and smoking.
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	4. A.P. Academy Book 5. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : V	
Name of the Topic	Fish Preservation Advanced methods – chilling or icing, refrigerated sea water, freezing, canning, irradiation
Hours required	4
Learning Objectives	Through the Internet and from the Books
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Fish Preservation Advanced methods – chilling or icing, refrigerated sea water, freezing, canning, irradiation
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. A.P. Academy Book 2. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : V	
Name of the Topic	Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein
Hours required	6
Learning Objectives	Through the Internet and from the Books
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein etc was discussed
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. A.P. Academy Book 2. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : V	
Name of the Topic	Sanitation in processing plants and Quality Control of fish and fishery products
Hours required	8
Learning Objectives	Through the Internet and from the Books
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing. Quality Control of fish and fishery products – pre-processing control, control during processing
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. A.P. Academy Book 2. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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Proforma for Teaching Plan

Name of the Department/Subject : Zoology	
Name of the Lecturer : Dr. K.R.SHANMUGAM	
Course/Group : B.Sc- B.Z.C- English Medium	
Paper : V	
Name of the Topic	Quality Assurance, Management and Certification
Hours required	14
Learning Objectives	Through the Internet and from the Books
Previous knowledge to be reminded	Yes before starting the topic, ask the students about the previous information about the topic and then start the topic
Topic Synopsis	GMP, GLP, SOP, HACCP and ISO 9000:2000 etc was discussed
Examples/Illustrations	Giving the handouts, so the students now how the topic was discussed
Additional inputs	None
Teaching Aids used	Chalk piece, Black board, and giving the Handouts about the topic
References Cited	1. A.P. Academy Book 2. Source from Internet
Student Activity Planned after the teaching	Conducted Exam
Activity planned outside the Class room, if any	None
Any other activity	None

Signature of the Lecturer

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DEPARTMENT OF STATISTICS

Teaching Plan Semester I

2022-23

Dr.G.Varalakshmi

Commissionerate of Collegiate Education, A.P.
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Teaching Plan Semester I

Name of the Topic	Measure of central Tendency
Hours required	4
Learning Objectives	Arithematic Mean
Previous knowledge to be reminded	
Topic Synopsis	Central value is called a measure of central tendency or an average or a measure of locations. There are five averages. Among them mean, median and mode are called simple averages and the other two averages geometric mean and harmonic mean are called special averages. 1.
Examples/Illustrations	Aggregate of Marks
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

Lecturer

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Teaching Plan Semester I

Name of the Topic	Measure of central Tendency
Hours required	4
Learning Objectives	Arithematic Mean,Median, Mode and GM and HM
Previous knowledge to be reminded	Secondary data
Topic Synopsis	***Arithmetic mean or mean :*** Arithmetic mean or simply the mean of a variable is defined as the sum of the observations divided by the number of observations. If the variable x assumes n values $x_1, x_2 \ldots x_n$ then the mean, x, is given by $\bar{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$
Examples/Illustrations	Aggregate of Marks
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

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Commissionerate of Collegiate Education, A.P.
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Teaching Plan Semester I

Name of the Topic	Measure of central Tendency
Hours required	4
Learning Objectives	Arithematic Mean,Median, Mode and GM and HM
Previous knowledge to be reminded	Secondary data
Topic Synopsis	***Arithmetic mean or mean :*** Arithmetic mean or simply the mean of a variable is defined as the sum of the observations divided by the number of observations. If the variable x assumes n values $x_1, x_2 \ldots x_n$ then the mean, x, is given by $\bar{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$
Examples/Illustrations	Aggregate of Marks
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

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Teaching Plan Semester I

Name of the Topic	MEASURES OF DISPERSION –SKEWNESS AND KURTOSIS
Hours required	4
Learning Objectives	Variance
Previous knowledge to be reminded	Mean
Topic Synopsis	**Range:** This is the simplest possible measure of dispersion and is defined as the difference between the largest and smallest values of the variable. In symbols, Range = L – S. Where L = Largest value. S = Smallest value ***Standard Deviation Definition:*** It is defined as the positive square-root of the arithmetic mean of the Square of the deviations of the given observation from their arithmetic mean.The standard deviation is denoted by the Greek letter σ(sigma)
Examples/Illustrations	Aggregate of Marks
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

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Teaching Plan Semester I

Name of the Topic	Moments –SKEWNESS AND KURTOSIS
Hours required	4
Learning Objectives	Moments ,Skewness and Kurtosis
Previous knowledge to be reminded	Disperssion
Topic Synopsis	**Definition of moments:** Moments can be defined as the arithmetic mean of various powers of deviations taken from the mean of a distribution. These moments are known as central moments.
Examples/Illustrations	Aggregate of Marks
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

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Teaching Plan Semester I

Name of the Topic	MEASURES OF DISPERSION –SKEWNESS AND KURTOSIS
Hours required	4
Learning Objectives	Kurtosis
Previous knowledge to be reminded	Moments
Topic Synopsis	**Measure of Kurtosis:** The measure of kurtosis of a frequency distribution basedmoments is $\beta_2 = \frac{\mu_4}{\mu_2^2}$ denoted by β_2 and is given by If $\beta_2 = 3$, the distribution is said to be normal and the curveis mesokurtic. If $\beta_2 > 3$, the distribution is said to be more peaked and the curve is leptokurtic. If $\beta_2 < 3$, the distribution is said to be flat topped and the curve is platykurtic.
Examples/Illustrations	Aggregate of Marks
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

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Teaching Plan Semester I

Name of the Topic	MEASURES OF DISPERSION –SKEWNESS AND KURTOSIS
Hours required	4
Learning Objectives	Kurtosis
Previous knowledge to be reminded	Moments
Topic Synopsis	**Measure of Kurtosis:** The measure of kurtosis of a frequency distribution basedmoments is $\beta_2 = \frac{\mu_4}{\mu_2^2}$ denoted by β_2 and is given by If $\beta_2 = 3$, the distribution is said to be normal and the curveis mesokurtic. If $\beta_2 > 3$, the distribution is said to be more peaked and the curve is leptokurtic. If $\beta_2 < 3$, the distribution is said to be flat topped and the curve is platykurtic.
Examples/Illustrations	Aggregate of Marks
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

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Teaching Plan Semester I

Name of the Topic	MEASURES OF DISPERSION –SKEWNESS AND KURTOSIS
Hours required	4
Learning Objectives	Kurtosis
Previous knowledge to be reminded	Moments
Topic Synopsis	**Measure of Kurtosis:** The measure of kurtosis of a frequency distribution basedmoments is $\beta_2 = \frac{\mu_4}{\mu_2^2}$ denoted by β_2 and is given by If $\beta_2 = 3$, the distribution is said to be normal and the curveis mesokurtic. If $\beta_2 > 3$, the distribution is said to be more peaked and the curve is leptokurtic. If $\beta_2 < 3$, the distribution is said to be flat topped and the curve is platykurtic.
Examples/Illustrations	Aggregate of Marks
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

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Commissionerate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan Semester I

Name of the Topic	MEASURES OF DISPERSION –SKEWNESS AND KURTOSIS
Hours required	4
Learning Objectives	Kurtosis
Previous knowledge to be reminded	Moments
Topic Synopsis	**Measure of Kurtosis:** The measure of kurtosis of a frequency distribution basedmoments is $\beta_2 = \frac{\mu_4}{\mu_2^2}$ denoted by β_2 and is given by If $\beta_2 = 3$, the distribution is said to be normal and the curveis mesokurtic. If $\beta_2 > 3$, the distribution is said to be more peaked and the curve is leptokurtic. If $\beta_2 < 3$, the distribution is said to be flat topped and the curve is platykurtic.
Examples/Illustrations	Aggregate of Marks
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

Lecturer

Department I/C

Principal

Commissionerate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan Semester I

Name of the Topic	Correlation
Hours required	4
Learning Objectives	Correlation
Previous knowledge to be reminded	Average
Topic Synopsis	Correlation is statistical Analysis which measures and analyses the degree or extent to which the two variables fluctuate with reference to each other. The word relationship is important. It indicates that there is some connection between the variables. It measures the closeness of the relationship. Correlation does not indicate cause and effect relationship. Price and supply, income and expenditure are correlated
Examples/Illustrations	Aggregate of Expenditure
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

Lecturer

Department I/C

Principal

Commissionerate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan Semester I

Name of the Topic	Correlation
Hours required	4
Learning Objectives	Correlation
Previous knowledge to be reminded	Average
Topic Synopsis	Correlation is statistical Analysis which measures nd analyses the degree or extent to which the two ariables fluctuate with reference to each other. The ord relationship is important. Itindicates that there s some connection between the variables. It easures the closeness of the relationship. orrelation does not indicate cause and effect elationship. Price and supply, income and xpenditure are correlated
Examples/Illustrations	Aggregate of Expenditure
Additional inputs	MCQ
Teaching Aids used	Calculater
References cited	Fundamental of Mathematics by S.C.Gupta amd Chand
Any other activity	DPT

Lecturer

Department I/C

Principal

PRR & VS GOVERNMENT DEGREE COLLEGE

VIDAVALUR, SPSR NELLORE – Dist., A.P.

(Accredited with B+ Grade by NAAC)

Estd. 1965

SC. SRINIVASULU

Lecturer in Commerce

DEPARTMENT OF COMMERCE

Teaching Notes

Semester – I, III & V

(2022-23)

Teaching Plan – ~~Business Statistics~~ Fundamentals of Accounting-I – I B.Com.,

e of the Topic	Introduction to Accounting
-s required	10
ning Objectives	Need for Accounting, meaning, Objectives, Book Keeping, Classification of Accounts
ous knowledge to be reminded	Yes
: Synopsis unting: Accounting has rightly been termed ie language of the business. The basic tion of a language is to serve as a ns of communication. Accounting communicates the result siness operations to various parties have some stake in the business. With elp of accounting records the business e to ascertain the profit or loss and the cial position of the business at the end iven period and communicate such nation to all interested parties. ves of Accounting: To keep systematic records. To ascertain the operational profit or loss	iii) To ascertain the financial position the business iv) To facilitate rational decision maki **Book Keeping:** Book-keeping and accounting are differ from each other. Book-keeping is mainly concerned with recording of financial data relating to business operations in a significant and orderly manner. Book-keeping invo the systematic recording of the finar transactions and the maintenance of correct & up-to-date financial records o organization. Accounting is primarily conce with designing the systems for recor classifying and summarizing the data interpreting them for internal and ext end users.
es/Illustrations	Given
nal inputs	Given
g Aids used	Black Board
ces cited	Books
	Group Discussion and

Commissionerate of Collegiate Education, A.P.

PRR & VS Government College, Vidavalur, SPSR Nellore Dist

Teaching Plan – ~~Business Statistics~~ Fundamentals of Accounting-I – I B.Com.,

lame of the Topic	Introduction to Accounting
lours required	10
earning Objectives	Need for Accounting, meaning, Objectives, Book Keeping, Classification of Accounts
revious knowledge to be reminded	Yes
opic Synopsis ccounting: Accounting has rightly been termed is the language of the business. The basic function of a language is to serve as a neans of communication. Accounting communicates the result of business operations to various parties who have some stake in the business. With he help of accounting records the business s able to ascertain the profit or loss and the inancial position of the business at the end f a given period and communicate such nformation to all interested parties. jectives of Accounting: i) To keep systematic records. ii) To ascertain the operational profit or loss	iii) To ascertain the financial position of the business iv) To facilitate rational decision making Book Keeping: Book-keeping and accounting are different from each other. Book-keeping is mainly concerned with recording of financial data relating to the business operations in a significant and orderly manner. Book-keeping involves the systematic recording of the financial transactions and the maintenance of the correct & up-to-date financial records of the organization. Accounting is primarily concerned with designing the systems for recording, classifying and summarizing the data and interpreting them for internal and external end users.
amples/Illustrations	Given
ditional inputs	Given
aching Aids used	Black Board
erences cited	Books
dent Activity planned after the ching	Group Discussion and problems
...planned outside the Class room, if any	

Commissionerate of Collegiate Education, A.P.
& VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan – Business Statistics – I B.Com., Fundamentals of Accounting -I

f the Topic	Bank Reconciliation Statement
equired	10
g Objectives	Meaning and Need of BRS
s knowledge to be reminded	Yes
ynopsis g: Bank Reconciliation Statement is a ent prepared, periodically with a o enlist the reasons for difference n the balances as per the bank of the cashbook and pass ank statement on any given date. preparing Bank Reconciliation nt: Reconciliation Statement is a reconciling the balance as shown ank passbook and the balance as the Bank column of the Cashbook. tive of preparing such a statement the causes of difference between balances and to reconcile these	Causes of differences between Cash Book and Pass Book: i) Cheques issued by the Trader but not yet presented for payment ii) Cheques deposited into bank but not yet collected or credited by the Bank iii) Amount directly deposited by customers/debtors in the bank account iv) Bank charges charged by the Bank v) Interest and dividend received by the bank on behalf of the customer vi) Direct payments made by the bank on behalf of the customer vii) Dishonour of cheques deposited with bank viii) Errors committed in recording transactions by the firm
Illustrations	Given
inputs	Given
ids used	Black Board
cited	Books
tivity planned after the	Group Discussion and problems
ned outside the Class room, if any	

Directorate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan – Business Statistics – II B.Com.,

Name of the Topic	Introduction to Statistics
Hours required	10
Learning Objectives	Definition, importance and Limitations of Statistics, Schedule and Questionnaire
Previous knowledge to be reminded	Yes
Topic Synopsis ntroduction: For a layman, 'Statistics' means numerical information expressed in quantitative terms. This information may relate to objects, subjects, activities, phenomena, or regions of space. efinition: A.L. Bowley has defined statistics as: (i) atistics is the science of counting, (ii) atistics may rightly be called the science of erages, and (iii) statistics is the ience of measurement of social organism garded as a whole in all its manifestations portance of statistics : w a days statistical methods and nciples are widely used in various fields knowledge. To business: Success of business depends n efficient management of production sales which in turn depend on location, , marketing and quality control.	(ii) To Government: Statistics help the government in envisaging various welfare programmes. **Limitations of Statistics** Statistics has a number of limitations, pertinent among them are as follows: (i) Statistics deals only with quantitative aspects of the problems (ii) Statistics deals with aggregate of facts (iii) Statistical results are true only on an average (iv) Statistics is only a means and not an end **Questionnaires:** Collection of data through questionnaires is an important and popular method. Under this method the data is collected with the help of particular form containing a number of questions which are designed to collect the necessary data relating to the object of the investigation.
mples/Illustrations	Given
litional inputs	Given
ching Aids used	Black Board
rences cited	Books
ent Activity planned after the ing	Group Discussion and problems
ity planned outside the Class room, if any	
other activity	

Commissionerate of Collegiate Education, A.P.
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Teaching Plan – Business Statistics – II B.Com.,

Name of the Topic	Measures of Central Tendency
Hours required	10
Learning Objectives	Characteristics of Measures of Central Tendency and Types of Averages
Previous knowledge to be reminded	Yes
Topic Synopsis Introduction: The measures of central tendency are the most popularly used tools to condense the mass data and represent it through single numbers. It enables us to compare two or more distributions pertaining to the same time period or within the same distribution over time. Average: One of the important and essential measures of summarizing the data in statistical analysis is average. Average is the method of reducing the mass and complex data into a single representative numerical figure. Types of Averages. Arithmetic Mean Median Mode Geometric Mean Harmonic Mean	ARITHMETIC MEAN Adding all the observations and dividing the sum by the number of observations results the arithmetic mean. MEDIAN Median is defined as the value of the middle item (or the mean of the values of the two middle items) when the data are arranged in an ascending or descending order of magnitude. MODE It is the value at the point around which the items are most heavily concentrated.
Examples/Illustrations	Given
Additional inputs	Given
Teaching Aids used	Black Board
References cited	Books
Student Activity planned after the teaching	Group Discussion and problems
Activity planned outside the Class room, if any	
Any other activity	

Principal

Commissionerate of Collegiate Education, A.P.
& VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan –Cost Accounting – III B.Com.,

f the Topic	Introduction to Cost Accounting
equired	10
g Objectives	Meaning of Cost Accounting, Different concepts of Cost Accounting
knowledge to be reminded	Yes – Cost sheet preparation
nopsis ounting: mpared to the financial accounting, cus of cost accounting is different. utation of cost on scientific basis ereafter cost control and cost ion has become of paramount tance. st can be defined as the enditure (actual or notional) rred on or attributable to a given . Costing: may be defined as 'the technique cess of ascertaining costs'. nting: counting primarily deals with n, analysis of relevant of cost interpretation and presentation us problems of management.	**Difference between Cost Accounting and Financial Accounting:** **Financial Accounting** / **Cost Accounting** It aims at finding out results of accounting year in the form of P&L Account and Balance Sheet. / It aims at computing cost of production/service in a scientific manner and then cost control and cost reduction. Financial Accounting data is historical in nature / It not only deals with historical data but is also futuristic in approach. It aims at presenting 'true and fair' view of the profit and loss position as well as financial position. / It aims at computing 'true and fair' view of the cost of production/services offered by the firm.
llustrations	Given
nputs	Given
ds used	Black Board
ited	Books
vity planned after the	Group Discussion and problems
ed outside the Class room, if any	
ivity	

Directorate of Collegiate Education, A.P.
PRR & VS Government College, Vidavalur, SPSR Nellore Dist
Teaching Plan –Cost Accounting – III B.Com.,

ame of the Topic	Job Costing
ours required	10
earning Objectives	Job Costing Features, Advantages and Limitations
revious knowledge to be reminded	Yes – Cost sheet preparation
opic Synopsis	

ob Costing:

his method of costing is used in Job Order ıdustries where the production is as per e requirements of the customer. In Job rder industries, the production is not on ntinuous basis, rather it is only when order om customers is received and that too as r the specifications of the customer.

atures of job costing:

i) It is a specific order costing.
ii) A job is carried out or a product is produced to meet the specific requirements of the order.
iii) Job costing enables a business to ascertain the cost of a job on the basis of which quotation for the job may be given.

Advantages of Job Costing:

i) Accurate information is available regarding the cost of the job completed and the profits generated from the same.
ii) Proper records are maintained regarding the material, labor and overheads so that a costing system is built up.
iii) Useful cost data is generated from the point of view of management for proper control and analysis.

Limitations of Job Costing

i) It is said that it is too time consuming and requires detailed record keeping. This makes the method more expensive.
ii) Record keeping for different jobs may prove complicated

amples/Illustrations	Given
ditional inputs	Given
aching Aids used	Black Board
erences cited	Books
dent Activity planned after the hing	Group Discussion and problems
vity planned outside the Class room, if any	
other activity	

R & VS Government College, Vidavalur, SPSR Nellore Dist
State Education, A.P.

Teaching Plan – Cost Accounting – III B.Com.,

of the Topic	Marginal Costing
: required	10
ing Objectives	Meaning of Marginal Costing, Features and BEP Analysis
ous knowledge to be reminded	Yes
Synopsis luction: Marginal Costing is not a ethod of costing like job, or contract osting. It is in fact a technique of osting in which only variable anufacturing costs are considered hile determining the cost of goods sold d also for valuation of inventories. tion: ginal Cost is defined as, 'the change in ite costs due to change in the volume uction by one unit'. Marginal Costing has been defined ertainment of cost and measuring the on profits of the change in the of output or type of output. of Marginal Costing marginal costing, costs are gregated into fixed and variable. nly variable costs are charged to the oduction.	2. Another important feature of marginal costing is the valuation of inventory is done at variable cost only. **Break Even Point:** The Break Even Point is a level of production where the total costs are equal to the total revenue, i.e. sales. Thus at the break even level, there is neither profit nor loss. Production level below the break-even-point will result into loss while production above break-even point will result in profits. Break Even point [in units] = Fixed Cost / Contribution per Unit Break even point [in Rs.] = Fixed Cost / Profit Volume [P/V] Ratio
/Illustrations	Given
l inputs	Given
Aids used	Black Board
cited	Books
tivity planned after the	Group Discussion and problems