

**PRR & VS Government College, Vidavalur**  
**Department of Computer Science / Applications**



**Teaching Notes 2023-24**

**B.Vidyullatha,**  
**Lecturer in Computer Science**

P.R.R. & V.S. GOVERNMENT COLLEGE, VIDAVALUR, SPSR NELLORE DT.

TEACHING PLAN 2023-24

Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - III
Paper	Database Management Systems
Name of the topic	Introduction to DBMS
Hours Required	1
Learning Objectives	Understand the basic concepts of DBMS
Previous Knowledge to be Reminded	Student Data

**Topic Synopsis :**

**What is Data?**

Data is a raw and unorganized fact that required to be processed to make it meaningful. Data can be represented in various forms i.e. in figures, characters, symbols, pictures, audio, video etc.

**What is Information?**

Information is a set of data which is processed in a meaningful way according to the given requirement. Information is the processed, organized and structured data. It provides context for data and enables decision making.

**Example:**

Student's test score is data

The average score of a class is the information derived from the given data.

**Data Vs Information:**

Generally, before processing the collection of raw facts is called *Data*. After processing the data is called *Information*.

**Meta Data:** The data that describes the properties of another data is called Meta data. (or) Data about data is called Meta data.


**What is Database**


The database is a collection of inter-related data which is used to retrieve, insert and delete the data efficiently.

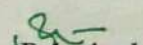
**Database Management System**

Database management system is a software which is used to manage the database.

Examples / Illustrations	Student Data
Additional Inputs	MS Access
Teaching Aids Used	Black Board
References Cited	DBMS by Korth and Internet
Student Activity planned after the Teaching	Questing & Answers methods , Assignment
Activity planned outside the class	
Any Other activity	

  
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**TEACHING PLAN 2023-24**

Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - III
Paper	Database Management Systems
Name of the topic	File-based System
Hours Required	1
Learning Objectives	Understand the drawbacks of file-based system
Previous Knowledge to be Reminded	Traditional file based System

**Topic Synopsis :**

In File-Based System, we have a collection of application programs, that performs a particular task for the users. Each program defines and manages its own data. Before the introduction of DBMS, the organizations are using File-Based System.


**Characteristics of File-Based System:**


- It stores data of an organization in group of files.
- Each file is independent from one another.
- Each file is called a *flat file*.
- Files are created by using programming languages such as C, C++ etc.
- Each file must have its own application program.
- It is less flexible and has many limitations.

**Drawbacks of file-based system:**

The File-Based System was used to storing and managing user's data. In File-Based System, we have a collection of application programs that performs particular works for the users. But many problems are occurred using this approach. They are  
Structural Dependency, Data Dependency, Limited data Sharing, Data Redundancy, Data Inconsistency, Integrity Problems

Examples / Illustrations	Student Data
Additional Inputs	
Teaching Aids Used	Blackboard
References Cited	DBMS by Korth and Internet
Student Activity planned after the Teaching	Questioning & Answers methods, Assignment
Activity planned outside the class	
Any Other activity	

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TEACHING PLAN 2023-24


Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyllatha
Course/ Group	II B.Sc Sem - III
Paper	Database Management Systems
Name of the topic	<b>Advantages of DBMS</b>
Hours Required	1
Learning Objectives	Understand the basic concepts of DBMS
Previous Knowledge to be Reminded	File based System


**Topic Synopsis :**

A Database Management System (DBMS) is a collection of programs used for managing the data in the database. It acts as an interface between the user and the database. The DBMS provides several advantages when compared to File-Based system.

1. Improved Data Sharing
2. Minimized Data Redundancy
3. Minimized Data Inconsistency
4. Improved Data Access
5. Improved Decision-Making
6. Improved Data Quality
7. Improved Data Security
8. Increased End-user's Productivity

Examples / Illustrations	Student Data
Additional Inputs	
Teaching Aids Used	PPT
References Cited	DBMS by Korth and Internet
Student Activity planned after the Teaching	Questing & Answers methods , Assignment
Activity planned outside the class	
Any Other activity	

  
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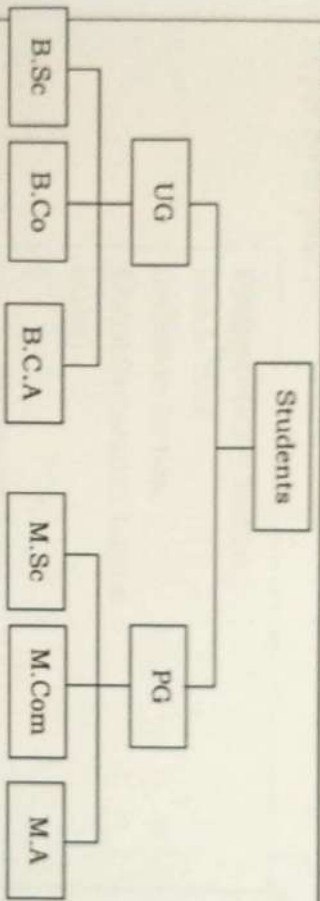
  
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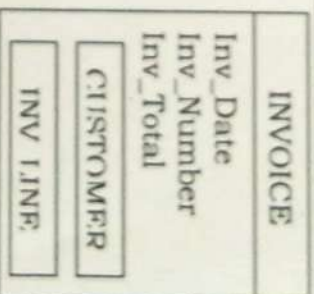
Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyalatha
Course/ Group	II B.Sc Sem - III
Paper	Database Management Systems
Name of the topic	<b>Various Data models</b>
Hours Required	1
Learning Objectives	Understand the basic concepts of DBMS
Previous Knowledge to be Reminded	

**Topic Synopsis :**

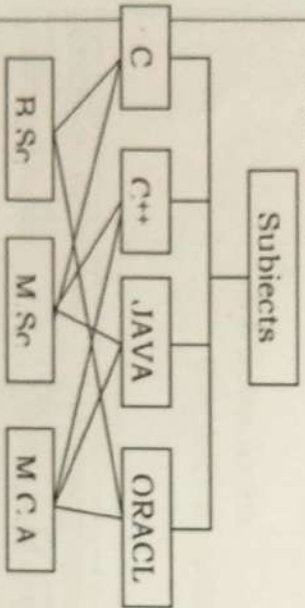
**Hierarchical Model**



**Object-Oriented Model**



**Network Model**



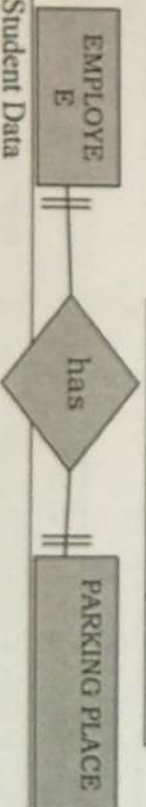
**Relational Model**

Table:

EMPNO	ENAME	SAL	DEPTNO
-------	-------	-----	--------

Table:

DEPTNO	DNAME	LOC
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Examples / Illustrations	Student Data
Additional Inputs	
Teaching Aids Used	PPT
References Cited	DBMS by Korth and Internet
Student Activity planned after the Teaching	Questioning & Answers methods, Assignment
Activity planned outside the class	
Any Other activity	

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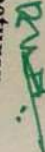
Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	I B.Sc Sem - II
Paper	Problem Solving using C
Name of the topic	Structure of C Program
Hours Required	1
Learning Objectives	Understand how to write a C program
Previous Knowledge to be Reminded	Algorithm

**Topic Synopsis :**

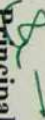
```

Documentation Section
Link Section
Definition Section
Global Declaration Section
main()
{
    Declaration Part;
    Executable Part;
}
Sub Program Section
User defined functions
    
```

Examples / Illustrations	Example program
Additional Inputs	Divide and Conquer technique
Teaching Aids Used	PPT
References Cited	Computing fundamentals & C programming by E.Balaguruswamy
Student Activity planned after the Teaching	Question & Answers
Activity planned outside the class	
Any Other activity	

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyllatha
Course/ Group	I B.Sc Sem - II
Paper	Problem Solving using C
Name of the topic	Operators in C
Hours Required	2
Learning Objectives	Understand various operators in C programming
Previous Knowledge to be Reminded	Mathematical operations

**Topic Synopsis : Operators in C**

An operator is a symbol that performs mathematical, relational or logical operations between operands. C supports mainly eight types of operators. They are

- ✓ Arithmetic operators
- ✓ Relational operators
- ✓ Logical operators
- ✓ Assignment operator
- ✓ Unary operators
- ✓ Conditional operator
- ✓ Bitwise operator
- ✓ Sizeof operator

Examples / Illustrations	Examples
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Computing fundamentals & C programming by E.Balaguruswamy
Student Activity planned after the Teaching	Quiz
Activity planned outside the class	Assignment
Any Other activity	

  
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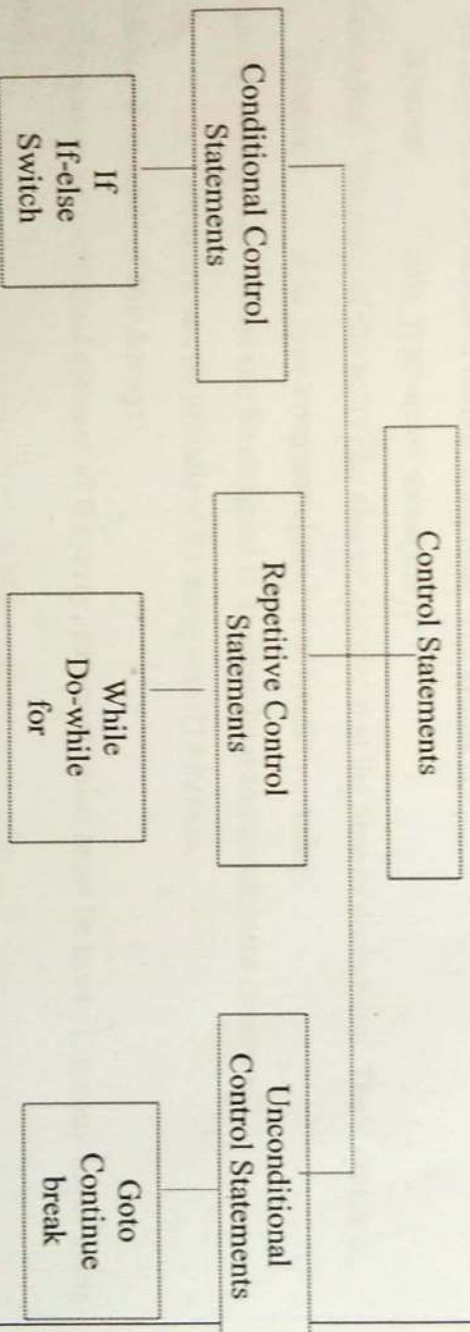
  
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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	I B.Se Sem - II
Paper	Problem Solving using C
Name of the topic	<b>Control statements</b>
Hours Required	5
Learning Objectives	Learn and use the statements in developing C programs
Previous Knowledge to be Reminded	

**Topic Synopsis :**

The 'C' language follows top-down programming approach. Control structures are used to change the execution sequence of a program. In C language, the control statements are classified into 3 types. They are as follows



Examples / Illustrations	Example programs
Additional Inputs	PPT
Teaching Aids Used	Computing fundamentals & C programming by E.Balaguruswamy
References Cited	Question & Answer
Student Activity planned after the Teaching	Assignment
Activity planned outside the class	
Any Other activity	

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	I B.Sc Sem - II
Paper	Problem Solving using C
Name of the topic	<b>One Dimensional Array</b>
Hours Required	2
Learning Objectives	Understand and learn how to use an array in C program
Previous Knowledge to be Reminded	Variables

**Topic Synopsis :**

An array is declared with only one dimension/subscript then it is called a "One dimensional (1-D) array".

**Declaration of 1-D Array:**

An array must be declared before being used. The syntax is,

**Syntax:**      data\_type array\_name[size];

**Initialization:** Elements of the array can also be initialized at the time of declaration. The syntax is,

**Syntax:**      data\_type arrayname[size]={val1, val2..... valn};

**Assigning values:** The values can be assigned to an array by using assignment operator.

An array can be initialized by using scanf() function..

**Accessing Elements of the Array:**

To access an individual element of the array, subscript/index must be used. The array index starts from 0.

Examples / Illustrations	Examples – student marks
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Computing fundamentals & C programming by E.Balaguruswamy
Student Activity planned after the Teaching	Discussion
Activity planned outside the class	Writing programs using arrays
Any Other activity	

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyllatha
Course/ Group	I B.Sc Sem - II
Paper	Problem Solving using C
Name of the topic	Functions
Hours Required	3
Learning Objectives	Implementing C programs using functions
Previous Knowledge to be Reminded	C program structure

**Topic Synopsis :**

• **Function declaration / prototype**

**Syntax:** return\_type function\_name (datatype arguments\_list);

• **Function definition**

```
return_type function_name(arguments_list)
{
    local variable declaration;
    statement block;
    return statement;
}
```

• **Function call**

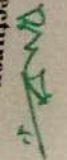
**Syntax:** function\_name(arguments\_list);

- The **return statement** is used to return a value from a user-defined function to its calling point. This statement can be used in the following ways:

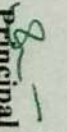
**Syntax-1: return ;**

**Syntax-2: return (value)**

Examples / Illustrations	Example programs
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Computing fundamentals & C programming by E.Balaguruswamy
Student Activity planned after the Teaching	Question & Answers
Activity planned outside the class	Programs using functions
Any Other activity	

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - IV
Paper	OOPs through Java
Name of the topic	Features of Java
Hours Required	1
Learning Objectives	Understand the features of Java
Previous Knowledge to be Reminded	Compiled programming languages

**Topic Synopsis :**

1. **Simple:** Simple programming language. Learning & practicing java is easy.
2. **Object Oriented:** Java is an Object -Oriented Programming language. This means Java Programs use Objects and Classes.
3. **Distributed:** Java is distributed because it encourages users to create distributed applications.
4. **Robust:** Robust means strong. Java programs are strong and they will not crash easily because of its exception handling and its memory management feature.
5. **Secured:** Java is a more secure language as compared to C/C++, as it does not allow a programmer to explicitly create pointers.
6. **Architecture Neutral: Write-once-run-anywhere (WORA)**
7. **Portable:** Java programs give the same result on any machine
8. **Interpreted:** Java programs are compiled to generate the byte code. This byte code can be interpreted by the interpreter in JVM.
9. **High Performance:** Java enables high performance with the use of just-in-time compiler (JIT) in JVM
10. **Multithreaded:** Java multithreading feature makes it possible to write program that can do many tasks simultaneously.
11. **Dynamic:** Java is a dynamic language. It supports the dynamic loading of classes.

Examples / Illustrations	Different programming languages
Additional Inputs	
Teaching Aids Used	Blackboard
References Cited	Core Java by Dr. R.Nageswara Rao
Student Activity planned after the Teaching	Question & Answers methods, Assignment
Activity planned outside the class	
Any Other activity	

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidhyullatha
Course/ Group	II B.Sc Sem - IV
Paper	OOPs through Java
Name of the topic	Basic Concepts of OOPS
Hours Required	1
Learning Objectives	Understand the features of OOPS
Previous Knowledge to be Reminded	POP

**Topic Synopsis :Basic Concepts of OOPS**

- Class / Object
- Encapsulation
- Abstraction
- Inheritance
- Polymorphism

**Class / Object:**

An object is anything that really exists in the real world and can be distinguished from others.  
 A class is a group name and does not exist physically, but objects exist physically.

**Encapsulation:**

Encapsulation is a mechanism where the data (variables) and the code (methods) that act on the data will bind together.

**Abstraction:**

Hiding unnecessary data from the user and expose only that data that is of interest to the user.

**Inheritance:**

It creates new classes from existing classes, so that the new classes will acquire all the features of the existing classes is called Inheritance.

**Polymorphism:**

Polymorphism represents the ability to assume several different forms.

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Core Java by Dr. R.Nageswara Rao
Student Activity planned after the Teaching	Questing & Answers methods, Assignment
Activity planned outside the class	
Any Other activity	

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - IV
Paper	OOPs through Java
Name of the topic	<b>Polymorphism</b>
Hours Required	1
Learning Objectives	Learn and understand static and dynamic polymorphism
Previous Knowledge to be Reminded	OOPs concepts

**Topic Synopsis :**

Method Overloading	Method Overriding
Writing two or more methods with the same name but with different signatures is called method overloading.	Writing two or more methods with the same name and same signatures is called method overriding.
Method overloading is done in the same class.	Method overriding is done in super and sub classes.
In method overloading, method return type can be same or different.	In method overriding, method return types should also be same.
JVM decides which method is called depending on the difference in the method signatures.	JVM decides which method is called depending on the data type (class) of the object used to call the method.
Method overloading is done when the programmer wants to extend the already available feature.	Method overriding is done when the programmer wants to provide a different he already available feature.

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Core Java by Dr. R.Nageswara Rao
Student Activity planned after the Teaching	Questioning & Answers methods , Assignment
Activity planned outside the class	
Any Other activity	

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidullatha
Course/ Group	II B.Sc Sem - IV
Paper	OOPs through Java
Name of the topic	<b>Creating a Thread and Running it</b>
Hours Required	1
Learning Objectives	Learn how to create, run and terminate a thread
Previous Knowledge to be Reminded	

**Topic Synopsis :**

**Creating a Thread and Running it:**

The following are the steps to create our own threads

**Step1:** Create a class that extends Thread class or implements Runnable Interface.  
class MyClass extends Thread or class MyClass implements Runnable

**Step2:** Now in this class write run() method as:  
public void run()  
{

Statements;

}

**Step3:** Create an object to MyClass so that run() method is available for execution MyClass  
obj=new MyClass();

**Step4:** Now create a thread and attach the thread to the object obj  
Thread t = new Thread(obj); or Thread t = new Thread (obj, "threadname");

**Step5:** Run the Thread. For this purpose we should use start() method of Thread class t.start();

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	System
References Cited	Core Java by Dr. R.Nageswara Rao
Student Activity planned after the Teaching	Questioning & Answers methods , Assignment
Activity planned outside the class	
Any Other activity	

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**TEACHING PLAN 2023-24**

Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - IV
Paper	OOPs through Java
Name of the topic	Stages in a JDBC Program
Hours Required	1
Learning Objectives	Java Database Connectivity
Previous Knowledge to be Reminded	MS Access

**Topic Synopsis :**

**Stages in a JDBC Program:**

- The following stages are used by Java Programmers while using JDBC in their programs:
- 1. Registering the driver:** A database driver is a software containing classes and interfaces written according to JDBC API. Since there are several drivers, we should first declare a driver which is going to be used for communication with the database server in a Java program.
  - 2. Connecting to a database:** In this stage, we establish a connection with a specific database through the driver which is already registered in the previous step.
  - 3. Preparing SQL statements in Java:** We should create SQL statements in our Java program using any of the interfaces that are available in java.sql package.
  - 4. Executing the SQL statements on the database:** For this purpose, we can use the methods of Statement interface.
  - 5. Retrieving the results:** The results obtained by executing the SQL statements can be stored in an object with the help of interfaces.
  - 6. Closing the Connection:** We should close the connection between the Java program and the database by using close() method of Connection interface.

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Core Java by Dr. R.Nageswara Rao
Student Activity planned after the Teaching	Questing & Answers methods , Assignment
Activity planned outside the class	
Any Other activity	

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Department I/C *R.N.A.*

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - IV
Paper	Operating Systems
Name of the topic	Operating System and its functions
Hours Required	1
Learning Objectives	Understand and learn about operating system and its services
Previous Knowledge to be Reminded	Software and hardware

**Topic Synopsis :**

**Definition:** *An operating system is system software, that acts as interface between user and computer.*

*It is used to control resources such as the CPU, memory, input/output devices and overall operations of computer system.*

The various services or functions provided by an operating system are as follows:

1. Program Execution
2. I/O Operations
3. File System Manipulation
4. Error Handling
5. Resource Manager
6. User Interface
7. Multitasking
8. Security
9. Networking

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	Blackboard
References Cited	Operating System Principles by Abraham Silberschatz, Peter Baer Galvin
Student Activity planned after the Teaching	Question & Answers methods , Assignment
Activity planned outside the class	
Any Other activity	

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - IV
Paper	Operating Systems
Name of the topic	Types of Operating Systems
Hours Required	1
Learning Objectives	Understand different types of operating systems
Previous Knowledge to be Reminded	

**Topic Synopsis :**

**Types of Operating Systems (Evolution of OS):**

Operating Systems are classified into different categories. Following are some of the most widely used types of Operating system.

- 1. Simple Batch System:** *In Batch Processing System, computer programs are executed as 'batches'. In this system, programs are collected, grouped and executed at a time.*
- 2. Multiprogramming System:** *In a multiprogramming system, one or more programs are loaded into main memory. Only one program is executed at a time by the CPU. All the other programs are waiting for execution.*
- 3. Distributed Systems:** *In Distributed Operating System, the workload is shared between two or more computers, linked together by a network.*
- 4. Real Time Systems:** *A Real Time Operating System (RTOS) is a special-purpose operating system. RTOS is a very fast and small operating system. It is also called Embedded system.*
- 5. Time sharing Operating Systems:** *It allows multiple users simultaneously share CPU's time. This OS, allots a time slot to each user for execution.*

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Operating System Principles by Abraham Silberschatz, Peter Baer Galvin
Student Activity planned after the Teaching	Question & Answers methods , Assignment
Activity planned outside the class	
Any Other activity	

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TEACHING PLAN 2023-24

Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - IV
Paper	Operating Systems
Name of the topic	User and kernel mode
Hours Required	1
Learning Objectives	Learn and understand modes of operation in OS
Previous Knowledge to be Reminded	

**Topic Synopsis :**

**User Mode and Kernel Mode.**

There are two modes of operation in the operating system to make sure it works correctly. These are

1. User mode
2. Kernel mode.

**1. User Mode**

The system is in user mode when the operating system is running a user application such as handling a text editor.

The mode bit is set to 1 in the user mode. It is changed from 1 to 0 when switching from user mode to kernel mode.

**2. Kernel Mode**

➤ A Kernel is a computer program that is the heart of an Operating System.

➤ The system starts in kernel mode when it boots and after the operating system is loaded, it executes applications in user mode.

➤ The mode bit is set to 0 in the kernel mode. It is changed from 0 to 1 when switching from kernel mode to user mode.

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Operating System Principles by Abraham Silberschatz, Peter Baer Galvin
Student Activity planned after the Teaching	Questing & Answers methods, Assignment
Activity planned outside the class	
Any Other activity	

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Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - IV
Paper	Operating Systems
Name of the topic	Scheduling algorithms
Hours Required	3
Learning Objectives	Learn how process scheduling is done in OS
Previous Knowledge to be Reminded	

**Topic Synopsis :**

Process Scheduling Algorithms

*Scheduling algorithms are used to decide, which of the process in the queue should be allocated to the CPU. An Operating System uses Dispatcher, which assigns a process to the CPU.*

**Types of Scheduling Algorithms:**

The scheduling algorithms are classified into two types. They are as follows:

**I. Non-Preemptive Algorithms:**

A non-preemptive algorithm will not prevent currently running process. In this case, once the process enters into CPU execution, it cannot be pre-empted, until it completes its execution.


- Ex:** (1). First Come First Serve (FCFS)  
(2). Shortest Job First (SJF)

**II. Preemptive Algorithms:**

A preemptive algorithm will prevent the currently running process. In this case, the currently running process may be interrupted and moves to the Ready state. The preemptive decision is performed, when a new process arrives or when an interrupt occurs or a time-out occurs.

**Ex: Round Robin (RR)**

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	System
References Cited	Operating System Principles by Abraham Silberschatz, Peter Baer Galvin
Student Activity planned after the Teaching	Questing & Answers methods , Assignment
Activity planned outside the class	
Any Other activity	

Lecturer 

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P.R.R. & V.S. GOVERNMENT COLLEGE, VIDAVVALUR, SPSR NELLORE DT.

TEACHING PLAN 2023-24

Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	II B.Sc Sem - IV
Paper	Operating Systems
Name of the topic	Deadlocks
Hours Required	6
Learning Objectives	Learn how to handle deadlocks
Previous Knowledge to be Reminded	

**Topic Synopsis :**

**Deadlock:** "Deadlock is a situation, when a set of processes are blocked, because each process is loading a resource, and waiting for another resource, acquired by some other process".

**Deadlock characterization (or) Conditions for Deadlock**

There are following 4 conditions that cause the occurrence of a deadlock.

1. Mutual exclusion
2. Hold and wait
3. No preemption
4. Circular wait

**Methods for Handling Deadlocks**

The deadlock problem can be solved in three ways. They are

1. Deadlock prevention
2. Deadlock Avoidance
3. Deadlock detection and recovery

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Operating System Principles by Abraham Silberschatz, Peter Baer Galvin
Student Activity planned after the Teaching	Questioning & Answers methods , Assignment
Activity planned outside the class	Assignment
Any Other activity	

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TEACHING PLAN 2023-24**

Name of the department / Subject	Computer Science	
Name of the Lecturer	B. Vidyullatha	
Course/ Group	III B.Sc Sem - V / VI	
Paper	Web Interface Designing Technologies	
Name of the topic	Differences between Web and Desktop applications	
Hours Required	1	
Learning Objectives	Understand the differences between Web and Desktop applications	
Previous Knowledge to be Reminded	Web and Desktop applications	

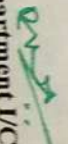
**Topic Synopsis :**

**Web Application vs Desktop Application**

Web Applications	Desktop Applications
Deployment and up-gradation for a web-based application require deployment on a single set of server machines.	Deployment and any up-gradation/patch are done on individual client machines separately.
Web applications can be accessed from anywhere, so there is no location constraint.	As desktop are confined to a standalone machine so they can be only accessed from the machines they are deployed in.
Web applications are platform-independent	Desktop applications need to be developed separately for different platform machines.
Web applications are at higher security risks as they are inherently designed to increase accessibility.	Desktop applications have better authorization and administrators have better control, hence more secure.
Web applications rely heavily on internet connectivity, for there operation.	Desktop applications don't require the internet for their operations.

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Chris Bates, Web Programming Building Internet Applications
Student Activity planned after the Teaching	Question & Answers
Activity planned outside the class	
Any Other activity	

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**TEACHING PLAN 2023-24**

Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	III B.Sc Sem - V / VI
Paper	Web Interface Designing Technologies
Name of the topic	HTML tags
Hours Required	1
Learning Objectives	Learn how to use basic tags of HTML
Previous Knowledge to be Reminded	

**Topic Synopsis :**

**HTML tags:**

- <h1> .....<h6> - heading tags
- <p> - paragraph
- <br> - line break
- <hr> - horizontal rule
- <b>, <strong> - bold
- <i>, <em> - italics
- <u> - underline
- <del> - strike through
- <sup> - superscript
- <sub> - subscript
- <mark>
- <img>
- <a>

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Chris Bates, Web Programming Building Internet Applications
Student Activity planned after the Teaching	Question & Answers
Activity planned outside the class	
Any Other activity	

Lecturer *R.V.S.*

Department I/C *R.V.S.*

Principal *R.V.S.*

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**TEACHING PLAN 2023-24**

Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyullatha
Course/ Group	III B.Sc Sem - V / VI
Paper	Web Interface Designing Technologies
Name of the topic	WordPress - Working with Pages
Hours Required	2
Learning Objectives	Learn how to add, publish, edit and delete pages
Previous Knowledge to be Reminded	

**Topic Synopsis :**

Steps to add pages in WordPress.

**Step (1)** – Click on **Pages** → **Add New** as shown in the following screenshot.

**Step (2)** – You will get the editor page as seen in the following screenshot. The editor page has two tabs, Visual and Text. You can insert text in either of these. Here, we'll study about inserting text into Visual format.

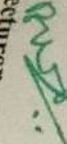
Steps to Publish Pages in WordPress.

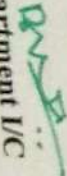
**Step (1)** – Click on **Pages** → **Add New** in WordPress.


**Step (2)** – You will get the editor as shown in the following screenshot. You can use the WordPress WYSIWYG editor to add the actual content of your page.

**Step (3)** – Click on **Publish** button as shown in the following screen.

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Word press for Beginners, Dr.Andy Williams
Student Activity planned after the Teaching	Question & Answers
Activity planned outside the class	Assignment
Any Other activity	

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**TEACHING PLAN 2023-24**

Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidyllatha
Course/ Group	III B.Com Sem – V / VI
Paper	E-COMMERCE APPLICATION DEVELOPMENT
Name of the topic	E-commerce v/s Traditional Commerce
Hours Required	1
Learning Objectives	Understand the difference between E-Commerce and Traditional Commerce
Previous Knowledge to be Reminded	


**Topic Synopsis :**

**Traditional Commerce:** Traditional commerce includes the exchange of goods and services between 2 people. The consumer going to the market, checking out a variety of goods, picking needed items, buying them and then paying the precise amount is what distinguishes traditional commerce. It is followed by everyone across the globe.

**E-Commerce:** E-commerce i.e., electronic commerce is similar to traditional commerce. It also includes the exchange of goods and services. The solitary difference is that it is handled online through an electronic network – the Internet. Now it has spread across to online social networks. With e-commerce, support, transactions and communication are done via the use of electronic communication. All trading activities including selling, ordering, buying, payments are executed over the internet.

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Turban, Rainer, and Potter, Introduction to E-Commerce
Student Activity planned after the Teaching	Question & Answers
Activity planned outside the class	
Any Other activity	

  
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**TEACHING PLAN 2023-24**

Name of the department / Subject	Computer Science
Name of the Lecturer	B. Vidvullatha
Course/ Group	III B.Com Sem - V / VI
Paper	E-COMMERCE APPLICATION DEVELOPMENT
Name of the topic	Scheduling algorithms
Hours Required	3
Learning Objectives	Learn how process scheduling is done in OS
Previous Knowledge to be Reminded	

**Topic Synopsis :**

The major different types of E-Commerce are:  
 E-Commerce can be defined as any form of business transaction in which the parties interact electronically. It could involve several trading steps, such as marketing, ordering, payment and support for delivery.

- Generally, E-commerce can be classified according to the transaction partners such as:
- Business-to-Business(B2B)
  - Business-to-Consumer(B2C)
  - Consumer-to-Consumer(C2C)
  - Business-to-Government(B2G)

Examples / Illustrations	
Additional Inputs	
Teaching Aids Used	PPT
References Cited	Chris Bates, Web Programming Building Internet Applications
Student Activity planned after the Teaching	Question & Answers
Activity planned outside the class	
Any Other activity	

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**PRR & VS GOVT.DEGREE COLLEGE,**

**VIDAVALUR, SPSR NELLORE DT.**

**DEPARTMENT OF BOTANY**



**2023-24**

**TEACHING NOTES**

**MULTIDISCIPLINARY COURSE-BOTANY**

**PRINCIPLES OF BIOLOGICAL SCIENCES**

<b>Name of the Department/Subject</b>	Botany
<b>Name of the Lecturer</b>	P. Sudhakar
<b>Course/Group</b>	BCom. BA
<b>Paper</b>	<b>Principles Of Biological Sciences</b>
<b>Name of the Topic</b>	Introduction-Branches and Basic Principles of Biology
<b>Hours Required</b>	2
<b>Learning Objectives</b>	Student will learn different branches and principles of biology
<b>Previous Knowledge to be reminded</b>	Biology Definition
<b>Examples/Illustrations</b>	Living and non-livings
<b>Additional Inputs</b>	Diagrams of various plants
<b>Teaching Aids Used</b>	Black board, laptop, ppt
<b>References Cited</b>	Telugu Akademi Books - Botany
<b>Student Activity Planned after teaching</b>	Interaction, quiz , student seminars
<b>Activities planned outside the class</b>	General observation of plants in college Garden
<b>Any other activity</b>	Slip test
<b>Synopsis</b>	

**CELL THEORY:** all living things are made of cells, and living cells come only from *other* living cells. Each living thing begins life as a single cell. Some living things, including bacteria, remain single-celled. Other living things, including plants and animals, grow and develop into many cells. Your own body is made up of an amazing 100 trillion cells. But even you — like all other living things — began life as a single cell.

#### **GENE THEORY**

**Gene theory** is the idea that the characteristics of living things are controlled by genes, which are passed from parents to their offspring. Genes are located on larger structures called chromosomes. Chromosomes are found inside every cell, and they consist of molecules of DNA (deoxyribonucleic acid). Those molecules of DNA are encoded with instructions that “tell” cells how to behave.

#### **HOMEOSTASIS**

**Homeostasis**, or the condition in which a system is maintained in a more-or-less steady state, is a characteristic of individual living things, like the human ability to sweat. Homeostasis also applies to the entire biosphere, wherever life is found on Earth. Consider the concentration of oxygen in Earth’s atmosphere. Oxygen makes up 21 per cent of the atmosphere, and this concentration is fairly constant.

#### **EVOLUTIONARY THEORY**

**Evolution** is a change in the characteristics of populations of living things over time. Evolution can occur by a process called **natural selection**, which results from random genetic mutations in a population. If these mutations lead to changes that allow the living things to better survive, then their chances of surviving and reproducing in a given environment increase. They will then pass more genes to the next generation. Over many generations, this can lead to major changes in the characteristics of those living things. Evolution explains how living things are changing today, as well as how modern living things descended from ancient life forms that no longer exist on Earth.

Signature of the Lecturer

Signature of the Principal

Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Biological Classification-Two kingdom and Five kingdom classification, Viruses, Viroid's and Lichens
Hours Required	2
Learning Objectives	Student will learn classifications, Viruses, Viroid's and Lichens
Previous Knowledge to be reminded	Viral diseases
Examples/Illustrations	Living and non-livings
Additional Inputs	Flowcharts of various systems.
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz, student seminars
Activities planned outside the class	General observation of plants in college Garden
Any other activity	Slip test
<b>Synopsis</b>	

### Two kingdom classification by Linnaeus:

Kingdom Plantae for plants and Kingdom Animalia for animals are the two major kingdoms. This two-kingdom classification laid the groundwork for modern classification and was quite reasonable at the time; plants and animals could be distinguished very clearly in this system.

### WHITTAKER FIVE KINGDOM CLASSIFICATION

Whittaker 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.

### Viruses, Viroids and Prions

Viroids consist of small, naked ssRNAs that cause diseases in plants. Virusoids are ssRNAs that require other helper viruses to establish an infection. Prions are proteinaceous infectious particles that cause transmissible spongiform encephalopathies. Prions are extremely resistant to chemicals, heat, and radiation.



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Signature of the Principal

Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Diversity in living world, Taxonomic categories, Taxonomic aids
Hours Required	2
Learning Objectives	Student will learn living world, Taxonomic categories and aids
Previous Knowledge to be reminded	Different classifications.
Examples/Illustrations	Division, Class, family etc
Additional Inputs	Flowcharts of various systems.
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz, student seminars
Activities planned outside the class	General observation of plants in college Garden
Any other activity	Slip test
Synopsis	

### Taxonomic Hierarchy Categories

**Kingdom:** The kingdom is the highest level of classification.

**Phylum:** This is the next level of classification and is more specific than the kingdom.

**Class:** Class was the most general rank in the taxonomic hierarchy until phyla were not introduced.

**Order:** Order is a more specific rank than class. The order has one or more than one similar families.

**Family:** This category of taxonomic hierarchy includes various genera that share a few similarities.

**Genus:** A group of similar species forms a genus. Some genera have only one species and is known as monotypic, whereas, some have more than one species and is known as polytypic.

**Species:** It is the lowest level of taxonomic hierarchy. There are about 8.7 million different species on earth. It refers to a group of organisms that are similar in shape, form, reproductive features. Species can be further divided into sub-species.

### Taxonomic aids

**Herbarium:** It is a store that houses a collection of preserved plant species.

**Botanical garden:** These are gardens in which specific plants are grown and are labelled according to their taxonomy.

**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.

**Zoological park:** These are places where animals and birds are kept in protected boundaries. An attempt is made to provide them with a habitat closest to their natural habitats. Thus, we get a chance to learn about their natural habits and behaviour. Zoological parks are open for human visits.

**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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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Structure and function of plant veg and reproductive organs
Hours Required	2
Learning Objectives	Student will learn Structure and function of plant organs
Previous Knowledge to be reminded	Parts of plant
Examples/Illustrations	Root, Stem, Leaves and Flower
Additional Inputs	Modifications of plant organs
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	General observation of plants in college Garden
Any other activity	Slip test
<b>Synopsis</b>	

### Root System

The root is a brown, nongreen and underground part of a plant. Root with their branches is collectively called a root system.

#### 1. Taproot System 2.The Fibrous root System 3. The Adventitious root System

### Shoot System

Another essential part of the plant is its stem. It is the ascending part of the plant axis which bears branches, leaves, flowers, fruits and helps in the conduction of water and minerals. It is the aerial part of the plant, developed from the plumule of an embryo or the germinating seeds.

**Leaves:** The leaf is a laterally borne structure and usually flattened. The main parts of the leaf include the leaf base, petiole, and lamina. They grow at the node and bear a bud at the axil. The arrangement of veins and veinlets in a leaf is called venation.

### Flowers:

The flowers are the reproductive part of the plant. The arrangement of flowers on the floral axis is called inflorescence, which has two major parts called racemose which let the main axis continue to grow and cymose which terminates the main axis in a flow.

### Fruits

The fruit is the characteristic feature of flowering plants, which is a ripened or mature ovary and the seed is what the ovules develop into after fertilization. The fruit that develops without fertilization is known as parthenocarpic.



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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Classification of Plant Kingdom
Hours Required	1
Learning Objectives	Student will learn living world, Taxonomic categorie
Previous Knowledge to be reminded	Differnt classifications.
Examples/Illustrations	Division,Class, family etc
Additional Inputs	Flowcharts of various systems.
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	General observation of plants in college Garden
Any other activity	Slip test
Synopsis	

### Classification of Kingdom Plantae

A plant kingdom is further classified into subgroups. Classification is based on the following criteria:

1. **Plant body:** Presence or absence of a well-differentiated plant body. E.g. Root, Stem and Leaves.
2. **Vascular system:** Presence or absence of a vascular system for the transportation of water and other substances. E.g. Phloem and Xylem.
3. **Seed formation:** Presence or absence of flowers and seeds and if the seeds are naked or enclosed in a fruit.

The plant kingdom has been classified into five subgroups according to the above-mentioned criteria:

1. Thallophyta
2. Bryophyta
3. Pteridophyta
4. Gymnosperms
5. Angiosperms

### Cryptogams and Phanerogams

The plant kingdom is also classified into two groups:

Cryptogams – Non-flowering and non-seed bearing plants. E.g. Thallophyta, Bryophyta, Pteridophyta

Phanerogams – Flowering and seed-bearing plants. E.g. Gymnosperms, Angiosperms

Signature of the Lecturer

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Basis of Animal Classification and Classification
Hours Required	1
Learning Objectives	Student will learn Animal Classification
Previous Knowledge to be reminded	Different classifications.
Examples/Illustrations	Division, Class, family etc
Additional Inputs	Flowcharts of various systems.
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz, student seminars
Activities planned outside the class	General observation of animals in college Garden
Any other activity	Slip test
Synopsis	

## Classification of Animal Kingdom

One of the most fundamental forms of classification of animals is the presence or absence of the notochord. Hence, two major groups exist, namely: Chordates and Non-chordates.

### Non-chordates and the Chordates

The notochord is a flexible rod made out of a material similar to cartilage. If an animal has a notochord during any stage of its life, it is classified as a chordate. Contrary chordates do not exclusively include vertebrates.

Members of phylum Porifera, Coelenterata, Ctenophora, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Hemichordata fall under Non-chordates.

Chordates are animals characterized by the presence of notochord at some stage during their development. Members possess a hollow nerve cord and pharyngeal gill slits. Phylum Chordata is divided into three subphyla: Urochordata, Cephalochordata, and Vertebrata.

### Subphylum – Urochordata

It is also referred to as Tunicata which are marine animals.

### Subphylum – Cephalochordata

It mainly consists of small, fish-like marine animals in which the notochord is extended along the entire body.

### Subphylum – Vertebrata

In this subphylum, the notochord is present in the embryonic stages and is replaced by a vertebral column in the adult.

### Classification of Vertebrates

1. Pisces
2. Amphibia
3. Reptilia
4. Aves
5. Mammalia

Signature of the Lecturer

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Ultra structure of cell and Cell organelles
Hours Required	1
Learning Objectives	Student will learn Ultra structure of cell and Cell organelles
Previous Knowledge to be reminded	prokaryotic cell and cell & Cell organelles
Examples/Illustrations	Bacteria, Amoeba, Chlorella
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Slip test
<b>Synopsis</b>	

Eukaryotic cells have a nucleus enclosed within the nuclear membrane and membrane bound cell organelle.

### **Structure Of Eukaryotic Cell**

The eukaryotic cell structure comprises the following:

**Plasma Membrane-** lipoproteinous layer.

**Cell Wall :**A cell wall is a rigid structure present outside the plant cell. It is, however, absent in animal cells.

### **Cytoskeleton**

The cytoskeleton is present inside the cytoplasm, which consists of microfilaments, microtubules, and fibres to provide perfect shape

### **luminal and extraluminal. Endoplasmic Reticulum**

It is a network of small, tubular structures that divides the cell surface into two parts:

**Nucleus:** The nucleoplasm enclosed within the nucleus contains DNA and proteins.

**Golgi Apparatus:** It is made up of flat disc-shaped structures called cisternae.

**Ribosomes:** These are the main site for protein synthesis and are composed of proteins and ribonucleic acids.

**Mitochondria:** These are also known as “powerhouse of cells” because they produce energy.

**Lysosomes:** They are known as “suicidal bags” because they possess hydrolytic enzymes

**Plastids:** These are double-membraned structures and are found only in plant cells. These are of three types: **Chloroplast** that contains chlorophyll and is involved in photosynthesis.

**Chromoplast** that contains a pigment called carotene that provides the plants yellow, red, or orange colours. **Leucoplasts** that are colourless and store oil, fats, carbohydrates, or proteins.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Plant cell vs Animal cell
Hours Required	1
Learning Objectives	Student will learn Ultra structure of cell and Cell organelles
Previous Knowledge to be reminded	prokaryotic cell and cell & Cell organelles
Examples/Illustrations	Bacteria, Amoeba, Chlorella
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Slip test
Synopsis	

## Difference between plants and animals

Major differences between the plants and the animals are given in the below-given table;

Plant cell	Animal cell
Cell wall is present	Cell wall absent
Chloroplast is present	Chloroplast is absent
The food is stored in the form of starch.	The food is stored in the form of glucose.
Chlorophyll is present	Chlorophyll is absent
Centrioles absent	Centrioles present

Both plant and animal cells comprise membrane-bound organelles, such as endoplasmic reticulum, mitochondria, the nucleus, Golgi apparatus, and lysosomes. The plant cell can also be larger than the animal cell. The normal range of the animal cell varies from about 10 – 30 micrometres and that of plant cell range between 10 – 100 micrometres.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Photosynthesis
Hours Required	1
Learning Objectives	Student will learn Photosynthesis, Respiration, Transportation
Previous Knowledge to be reminded	cell & Cell organelles
Examples/Illustrations	Xylem, stomata
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Slip test
<b>Synopsis</b>	

**Photosynthesis:** It is a physicochemical process that uses sunlight for the synthesis of organic compounds. In this process, oxygen is released into the atmosphere.

### Processes of Photosynthesis in Higher Plants

Photosynthesis in higher plants involves the following processes:

- Light Reaction
- Dark Reaction

**Light reaction:** The process involves- absorption of light, water splitting, the release of oxygen, and formation of ATP and NADPH.

### Photophosphorylation

The formation of ATP in the presence of sunlight is called photophosphorylation. It is of two types: 1. Non-cyclic photophosphorylation 2. Cyclic photophosphorylation

### Dark Reaction

This process occurs in the absence of light in the stroma of the **chloroplasts**. The following cycles are involved in the process:

This cycle involves the following steps:

1. Carbon-fixation: Ribulose-1, 5-bisphosphate combines with carbon dioxide to fix it to a 3 carbon compound 3-phosphoglyceric acid. The enzyme RuBisCO is involved in the process.
2. Reduction: 2 molecules of ATP and NADPH fixes one molecule of carbon dioxide to form glyceraldehyde-3-phosphate.
3. Regeneration: Some glyceraldehyde-3-phosphate molecules undergo a series of reactions to form glucose while the RuBP regenerates to continue the cycle.



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<b>Name of the Department/Subject</b>	Botany
<b>Name of the Lecturer</b>	P. Sudhakar
<b>Course/Group</b>	BCom. BA
<b>Paper</b>	<b>Principles Of Biological Sciences</b>
<b>Name of the Topic</b>	Respiration
<b>Hours Required</b>	1
<b>Learning Objectives</b>	Student will learn Respiration
<b>Previous Knowledge to be reminded</b>	cell & Cell organelles
<b>Examples/Illustrations</b>	Yeast, Bacteria
<b>Additional Inputs</b>	Notes
<b>Teaching Aids Used</b>	Black board, laptop, ppt
<b>References Cited</b>	Telugu Akademi Books - Botany
<b>Student Activity Planned after teaching</b>	Interaction, quiz , student seminars
<b>Activities planned outside the class</b>	Nil
<b>Any other activity</b>	Slip test
<b>Synopsis</b>	

## Respiration

It is a biochemical process wherein air moves between the external environment and the tissues and cells of the species. In respiration, inhalation of oxygen and exhalation of carbon dioxide gas takes place. As an entity acquires energy through oxidising nutrients and hence liberating wastes, it is referred to as a metabolic process.

## Aerobic Respiration

This type of respiration takes place in the mitochondria of all eukaryotic entities. Food molecules are completely oxidised into the carbon dioxide, water, and energy is released in the presence of oxygen. This type of respiration is observed in all the higher organisms and necessitates atmospheric oxygen. It involve the following steps:

1. Glycolysis
2. Link reaction
3. Krebs cycle
4. Electron transport system

## Anaerobic Respiration

This type of respiration occurs within the cytoplasm of prokaryotic entities such as yeast and bacteria. Here, lesser energy is liberated as a result of incomplete oxidation of food in the absence of oxygen.

Ethyl alcohol and carbon dioxide are produced during anaerobic respiration.

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<b>Name of the Lecturer</b>	P. Sudhakar
<b>Course/Group</b>	BCom. BA
<b>Paper</b>	<b>Principles Of Biological Sciences</b>
<b>Name of the Topic</b>	Transport in plants
<b>Hours Required</b>	1
<b>Learning Objectives</b>	Student will learn Transport in plants
<b>Previous Knowledge to be reminded</b>	Vascular tissues
<b>Examples/Illustrations</b>	Xylem, stomata
<b>Additional Inputs</b>	Notes
<b>Teaching Aids Used</b>	Black board, laptop, ppt
<b>References Cited</b>	Telugu Akademi Books - Botany
<b>Student Activity Planned after teaching</b>	Interaction, quiz , student seminars
<b>Activities planned outside the class</b>	Nil
<b>Any other activity</b>	Slip test
<b>Synopsis</b>	

### Transportation in Plants

The water and minerals are transported in plants by two types of conducting tissues:

- Xylem
- Phloem

#### **Xylem**

Xylem is a long, non-living tube running from the roots to the leaves through the stem. The water is absorbed by the root hair and undergoes cell to cell movement by osmosis until it reaches the xylem. This water is then transported through the xylem vessels to the leaves and is evaporated by the process of transpiration.

The xylem is also composed of elongated cells like the phloem. However, xylem is especially accountable for transporting water to all plant parts from the roots. Since they serve such an important function, a single tree would have a lot of xylem tissues.

#### **Phloem**

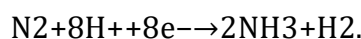
The phloem is responsible for translocation of nutrients and sugar like carbohydrates, produced by the leaves to areas of the plant that are metabolically active. It is made up of living cells. The cells walls of these cells form small holes at the ends of the cells known as sieve plates.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Mechanisms of Nitrogen fixation.
Hours Required	1
Learning Objectives	Student will learn Mechanisms of Nitrogen fixation.
Previous Knowledge to be reminded	Vascular tissues
Examples/Illustrations	Xylem, stomata
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Slip test
Synopsis	

Biological nitrogen fixation (BNF) occurs when atmospheric nitrogen is converted to ammonia by an enzyme called nitrogenase. The reaction for BNF is:



This type of reaction results in  $N_2$  gaining electrons (see above equation) and is thus termed a reduction reaction. While the equilibrium formation of ammonia from molecular hydrogen and nitrogen has an overall negative enthalpy of reaction (i.e. it gives off energy), the energy barrier to activation is very high without the assistance of catalysis, which is done by nitrogenases. The enzymatic reduction of  $N_2$  to ammonia therefore requires an input of chemical energy, released from ATP hydrolysis, to overcome the activation energy barrier.

Nitrogenase is made up of two soluble proteins: component I and II.

The hydrolysis of ATP supplies the energy for the reaction while the Fdx/Fld proteins supply the electrons.

Note this is a reduction reaction which means that electrons must be added to the  $N_2$  to reduce it to  $NH_4$ .

Thus, the role of component II is to supply electrons, one at a time to component I. ATP is not hydrolyzed to ADP until component II transfers an electron to component I.

21-25 ATPs are required for each  $N_2$  fixed. The association of nitrogenase component I and II and later dissociation occurs several times to allow the fixation of one  $N_2$  molecule (see step B and D).

Nitrogenase ultimately bonds each atom of nitrogen to three hydrogen atoms to form ammonia ( $NH_3$ ).

The nitrogenase reaction additionally produces molecular hydrogen as a side product, which is of special interest for people trying to produce  $H_2$  as an alternative energy source to fossil fuels.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Plant growth and development.
Hours Required	1
Learning Objectives	Student will learn Plant growth and development.
Previous Knowledge to be reminded	Body co-ordination.
Examples/Illustrations	IAA, IBA, Ethylene
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz, student seminars
Activities planned outside the class	Nil
Any other activity	Slip test
Synopsis	

#### Plant growth and development:

The important factors affecting the growth of plants include:

1. **Temperature:** Growth is accelerated with the increase in temperature.
2. **Light:** Light intensity, duration of light and the quality of light influence many physiological processes occurring in a plant.
3. **Water:** Water is an essential factor for plant growth. They grow well in a sufficient amount of water. They even respond to the scarcity of water.
4. **Soil Nutrients:** Plants require an adequate amount of nutrients for proper growth. The quality and quantity of nutrients affect plant growth.
5. **Plant Growth Regulators:** Various plant growth regulators such as auxin, cytokinin, gibberellins, etc. are added to plants to regulate their growth.

#### Development

The development includes all the changes that take place during the life cycle of a plant. There are different pathways followed by plants in response to the environment and form different structures.

The leaves of a young plant have different structures as compared to the mature plant.

Development is the sum total of growth and differentiation.

It is regulated by extrinsic and intrinsic factors.

Growth, differentiation, and development are closely related events.

A plant cannot develop if the cells do not grow and differentiate.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Physiology of flowering
Hours Required	01
Learning Objectives	Student will learn Physiology of flowering
Previous Knowledge to be reminded	Body co-ordination.
Examples/Illustrations	Phytochrome
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Nil
Any other activity	Slip test
Synopsis	

### Physiology of flowering:

Flowering in a plant occurs at a particular time of the year and controlled by many morphological and environmental conditions. Two important controlling factors are photoperiod or light period, *i.e.*, photoperiodism, low temperature *i.e.*, vernalization.

- (1) **Photoperiodism (Light period)** : The effects of photoperiods or daily duration of light periods (and dark periods) on the growth and development of plants, especially flowering is called photoperiodism.

The role of photoperiodism in the control of flowering was demonstrated for the first time by W.W Garner and H.A. Allard (1920). They observed that Maryland Mammoth variety of tobacco could be made to flower in summer by reducing the light hours with artificial darkening. It could be made to remain vegetative in winter by providing extra light. On the basis of length of photoperiod requirements of plants, the plants have been classified into following categories.

(i) **Short day plants (SDP)** : These plants initiate flowering when the day length (Photoperiod) become shorter than a certain critical period. Most of winter flowering plants belong to this category *e.g.*, cocklebur (*Xanthium*), *Chrysanthemum*, sugarcane, tobacco (Mutant Maryland Mammoth), soyabean, strawberry etc.,

(ii) **Long day plants (LDP)** : These plants begin flowering when the day length exceeds a critical length. This length too differs from species to species. The long day plants fail to flower, if the day length is shorter than the critical period. *e.g.*, spinach (*Spinacea oleracea*), henbane (*Hyoscymus niger*), radish, sugar-beet, wheat, lattuce, poppy, larkspur, maize etc.

(iii) **Day neutral plants** : These plants can flower in all possible photoperiods. The day neutral plants can blossom throughout the year. *e.g.*, cucumber, cotton, sunflower, tomato, some varieties of pea, etc.

**Critical period** : Critical photoperiod is that continuous duration of light, which must not be exceeded in short day plants and should always be exceeded in long day plant in order to bring them to flower.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Human Physiology: Digestion, Respiration, Circulation
Hours Required	01
Learning Objectives	Student will learn Digestion, Respiration, Circulation
Previous Knowledge to be reminded	Body co-ordination.
Examples/Illustrations	RBC,WBC
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	
Any other activity	NIL
Synopsis	
<p><b>Digestion Process:</b> The process of digestion begins from the mouth and ends in the small intestine – the large intestines’ main function is to absorb the remaining water from the undigested food and enable bacterial fermentation of materials that can no longer be digested.</p> <p>The alimentary canal begins from the mouth cavity and continues into the pharynx, through the stomach, small intestines, large intestines, and ending at the anus. Food particles gradually get digested as they travel through various compartments of the gastrointestinal tract.</p> <p><b>Respiration:</b> The interplay of respiration, circulation, and <u>metabolism</u> is the key to the functioning of the <u>respiratory system</u> as a whole.  <u>Cells</u> set the demand for oxygen uptake and <u>carbon dioxide</u> discharge, that is, for gas exchange in the lungs. The circulation of the blood links the sites of oxygen utilization and uptake.</p> <p><b>Human Circulatory System:</b> The human circulatory system consists of a network of arteries, veins, and capillaries, with the heart pumping blood through it.  Its primary role is to provide essential nutrients, minerals, and hormones to various parts of the body.</p> <p><b>Organs of Circulatory System:</b> The human circulatory system comprises 4 main organs that have specific roles and functions. The vital circulatory system organs include:</p> <ul style="list-style-type: none"> <li>• Heart</li> <li>• Blood (technically, blood is considered a tissue and not an organ)</li> <li>• Blood Vessels</li> <li>• Lymphatic system</li> </ul>	

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Male and female reproductive organs, fertilization
Hours Required	01
Learning Objectives	Student will learn Male and female reproductive organs, fertilization
Previous Knowledge to be reminded	Asexual reproduction and sexual reproduction.
Examples/Illustrations	Binary fission, yeast budding
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	nil
Any other activity	Slip test
Synopsis	

### Male Reproductive Anatomy

In the male reproductive system, the scrotum houses the testicles or testes (singular: testis), including providing passage for blood vessels, nerves, and muscles related to testicular function.

### Female Reproductive Anatomy

A number of reproductive structures are exterior to the female's body. These include the breasts and the vulva, which consists of the mons pubis, clitoris, labia majora, labia minora, and the vestibular glands,

### Gametogenesis (Spermatogenesis and Oogenesis)

Gametogenesis, the production of sperm and eggs, takes place through the process of meiosis. During meiosis, two cell divisions separate the paired chromosomes in the nucleus and then separate the chromatids that were made during an earlier stage of the cell's life cycle. Meiosis produces haploid cells with half of each pair of chromosomes normally found in diploid cells. The production of sperm is called spermatogenesis and the production of eggs is called oogenesis.

**Fertilisation:** In humans, the process of fertilization takes place in the fallopian tube. During this process, semen comprising thousands of sperms are inseminated into the female vagina during coitus. The sperms move towards the uterus and reach the opening of the fallopian tube.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Genetics: Mendel's laws of inheritance
Hours Required	01
Learning Objectives	Student will learn Genetics: Mendel's laws of inheritance
Previous Knowledge to be reminded	Asexual reproduction and sexual reproduction.
Examples/Illustrations	Parents and progeny
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	nil
Any other activity	NIL
Synopsis	

### Mendel's Experiments

Mendel experimented on a pea plant and considered 7 main contrasting traits in the plants. Then, he conducted both experiments to determine the inheritance laws. A brief explanation of the two experiments is given below.

### Monohybrid Cross

In this experiment, Mendel took two pea plants of opposite traits (one short and one tall) and crossed them. He found the first generation offspring were tall and called it F1 progeny. Then he crossed F1 progeny and obtained both tall and short plants in the ratio 3:1. To know more about this experiment, visit [Monohybrid Cross – Inheritance Of One Gene](#).

Mendel even conducted this experiment with other contrasting traits like green peas vs yellow peas, round vs wrinkled, etc. In all the cases, he found that the results were similar. From this, he formulated the **laws of Segregation And Dominance**.

### Dihybrid Cross

In a dihybrid cross experiment, Mendel considered two traits, each having two alleles. He crossed wrinkled-green seed and round-yellow seeds and observed that all the first generation progeny (F1 progeny) were round-yellow. This meant that dominant traits were the round shape and yellow colour.

He then self-pollinated the F1 progeny and obtained 4 different traits: round-yellow, round-green, wrinkled-yellow, and wrinkled-green seeds in the ratio 9:3:3:1.



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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Genetics: Colour blindness, Sickle cell anaemia
Hours Required	01
Learning Objectives	Student will learn Colour blindness, Sickle cell anaemia
Previous Knowledge to be reminded	sexual reproduction.
Examples/Illustrations	Parents and progeny
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	nil
Any other activity	NIL
Synopsis	

### What is sickle cell anemia?

Sickle cell anemia is a form of the inherited blood disorder, Sickle cell anemia. It affects your red blood cells, turning them from round flexible discs into stiff and sticky sickled cells. Sickled cells keep red blood cells from doing their job, which is carrying oxygen throughout your body. Sickled cells also don't live as long as normal red blood cells. As a result, you don't have enough healthy red blood cells and you develop anemia, the condition that gives sickle cell anemia its name.

In the past, babies born with sickle cell anemia rarely lived to be adults. Now, thanks to early detection and new treatments, about half of all people who have sickle cell anemia live into their 50s. People who have sickle cell anemia still face potentially life-threatening medical complications. However, healthcare providers have treatments that reduce the risk of complications and ease symptoms when they happen. (Unfortunately, there are many places in the world where people still don't have access to effective medical treatment for sickle cell anemia.)

**Color blindness or color vision deficiency (CVD)** is the decreased ability to see color or differences in color. The severity of color blindness ranges from mostly unnoticeable to full absence of color perception. Color blindness is usually an inherited problem or variation in the functionality of one or more of the three classes of cone cells in the retina, which mediate color vision. [https://en.wikipedia.org/wiki/Color\\_blindness](https://en.wikipedia.org/wiki/Color_blindness) - cite note-NEI2015-2 The most common form is caused by a genetic condition called congenital red-green color blindness (including protan and deutan types), which affects up to 1 in 12 males (8%) and 1 in 200 females (0.5%). The condition is more prevalent in males, because the opsin genes responsible are located on the X chromosome. Rarer genetic conditions causing color blindness include congenital blue-yellow color blindness (tritan type), blue cone monochromacy, and achromatopsia. Color blindness can also result from physical or chemical damage to the eye, the optic nerve, parts of the brain, or from medication toxicity. Color vision also naturally degrades in old age

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Geological time scale for evolution of plants and vertebrates,
Hours Required	01
Learning Objectives	Student will learn Geological time scale for evolutionn
Previous Knowledge to be reminded	Eras, Vedas,
Examples/Illustrations	Eras, Vedas, Dinosars
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	nil
Any other activity	NIL
Synopsis	

### Geological Time Scale and Evolution of Animals and Plants!

The first geological time scale was developed by Giovanni Avduina, Italian scientist in 1760. The age of the earth is about 4600 million years. Life first originated in water about 3600 million years ago. The history of the earth divided into a number of major divisions called eras and are sub-divided into periods. The modern periods are further divided into epochs.

**Evolution of Vertebrates:** Origin of vertebrates took place in Ordovician period in the form of ostracoderms. In fact ostracoderms were small, jawless bony fish-like forms. After the origin of ostracoderms acanthodians (the earliest known vertebrates with lower jaws) appeared in Silurian. Placoderms were in fact jawed fishes. Origin of amphibians occurred in Devonian. Reptiles appeared in Carboniferous. Origin of dinosaurs and mammals took place in Triassic. Toothed birds (first birds) appeared in Jurassic. Thus origin of fishes took place first, with amphibians next, followed by reptiles, then mammals and birds.

**Evolution of Plants:** Different kinds of algae were present in Cambrian. Marine algae were abundant in Ordovician. Origin of bryophytes took place before the appearance of vascular plants (pteridophytes, gymnosperms and angiosperms). Origin of vascular plants took place in Silurian. First gymnosperms appeared in Devonian. Origin of first seed plants occurred in Carboniferous. Angiosperms appeared in Cretaceous. Angiosperms diversified in Miocene and their adaptive radiation occurred in Pliocene.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Origin and evolution of plants and man
Hours Required	01
Learning Objectives	Student will learn Origin and evolution of plants and man
Previous Knowledge to be reminded	Eras, Vedas,
Examples/Illustrations	Eras, Vedas, Dinosars
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	nil
Any other activity	NIL
Synopsis	

### Stages in Human Evolution

The following are the stages of human evolution:

#### 1. Dryopithecus

These are deemed to be the ancestors of both man and apes. They lived in China, Africa, Europe and India. The genus Dryopithecus refers to the oak wood apes. When Dryopithecus was alive, the tropical lowlands which it inhabited were densely forested, so the members could have predominantly been herbivores.

#### 2. Ramapithecus

Their first remains were discovered from the Shivalik range in Punjab and later in Africa and Saudi Arabia. They lived in open grasslands. Two pieces of evidence confirm their Hominid status:

1. Thickened tooth enamel, robust jaws and shorter canines.
2. Usage of hands for food and defence and extrapolations of upright posture.

#### 3. Australopithecus

The fossil of this genus was first discovered in 1924 in South Africa. They lived on the ground, used stones as weapons and walked erect. They were 4 feet tall and weighed 60-80 pounds.

#### 4. Homo Erectus

The first fossil of Homo Erectus was found in Java in 1891. These were named as Pithecanthropus Erectus. This specimen had large cranial capacities and is believed to have lived in communities. Homo erectus used tools comprising quartz. Tools made of bones and wood were also discovered. There is evidence of collective huntings. There is also evidence of the use of fire. The Homo Erectus is believed to dwell in caves.

#### 5. Homo Sapiens Neanderthalensis

The Homo Erectus evolved into Homo Sapiens. During evolution, two sub-species of Homo Sapiens were identified- Homo sapien Neanderthal and Homo sapiens sapiens.

#### 6. Homo Sapiens Sapiens

The remains of Homo Sapiens were first discovered in Europe and were named Cro-Magnon. In these, the jaws are quite reduced, the modern man's chin appeared, and the skull was rounded. Their cranial capacity was about 1350 cc.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Malaria, dengue, AIDS, cancer, corona.
Hours Required	01
Learning Objectives	Student will learn malaria, dengue, AIDS, cancer, corona.
Previous Knowledge to be reminded	Vectors, pathogen and host
Examples/Illustrations	Flies, mosquitoes.
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	nil
Any other activity	NIL
Synopsis	

**Malaria:** it is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes. It is preventable and curable.

Quinine, mosquito net.

**Dengue: it** is a viral infection transmitted to humans through the bite of infected mosquitoes. About half of the world's population is now at risk of dengue with an estimated 100–400 million infections occurring each year.

**Acquired immunodeficiency syndrome (AIDS): it** is an ongoing, also called chronic, condition. It's caused by the human immunodeficiency virus, also called HIV. HIV damages the immune system so that the body is less able to fight infection and disease.

Sexual precautions.

**Cancer: it** is a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body. These contrast with benign tumors, which do not spread. [https://en.wikipedia.org/wiki/Cancer\\_-\\_cite\\_note-NCI2014-7](https://en.wikipedia.org/wiki/Cancer_-_cite_note-NCI2014-7) Possible signs and symptoms include a lump, abnormal bleeding, prolonged cough, unexplained weight loss, and a change in bowel movements. While these symptoms may indicate cancer, they can also have other causes. Over 100 types of cancers affect humans.

**Corona:** (from the Latin for 'crown') most commonly refers to:

- Stellar corona, the outer atmosphere of the Sun or another star
- Corona (beer), a Mexican beer
- Corona, informal term for the coronavirus or disease responsible for the COVID-19 pandemic:
  - SARS-CoV-2, severe acute respiratory syndrome coronavirus 2
  - COVID-19, coronavirus disease 2019



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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	Principles Of Biological Sciences
Name of the Topic	Plant diseases :Black spot, Leaf spots, Powdery mildew, Blight, Canker.
Hours Required	01
Learning Objectives	Student will learn Black spot, Leaf spots, Powdery mildew, Blight, Canker.
Previous Knowledge to be reminded	Vectors, pathogen and host
Examples/Illustrations	Flies, mosquitoes.
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	nil
Any other activity	NIL
Synopsis	

**Black Spot:** It is one of the most common diseases found on roses, but it can also occur on other ornamental and garden plants. This fungal disease causes black, round spots that form on the upper sides of leaves. Lower leaves are usually infected first. Severe infestations cause infected leaves to turn yellow and fall off the plant.

**Leaf Spots:** Fungal leaf spot disease can be found both indoors on houseplants, and outdoors in the landscape. This occurs during warm, wet conditions. As the disease progresses, the fungal spots grow large enough to touch each other. Leaf spot may result in defoliation of a plant. Follow the same tips as the ones to control black spot.

**Powdery Mildew:** Powdery mildew is a fungal disease that affects many of our landscape plants, flowers, vegetables and fruits. Powdery mildew is an easy one to identify. Infected plants will display a white powdery substance that is most visible on upper leaf surfaces, but it can appear anywhere on the plant including stems, flower buds, and even the fruit of the plant. It tends to affect plants kept in shady areas more than those in direct sun.

**Blight:** Plant blight is a common disease. Remember the potato famine in the 1840's? As a result of the blight, one million people died. But other than potatoes, blight also affects other plants, particularly tomatoes. Blight is a fungal disease that spreads through spores that are windborne. Prevention is the only option.

**Canker:** Canker is often identified by an open wound that has been infected by fungal or bacterial pathogens. Some cankers are not serious while others can be lethal. Canker occurs primarily on woody landscape plants. Symptoms may include sunken, swollen, cracked or dead areas found on stems, limbs or trunk. Cankers can girdle branches, and kill foliage. Cankers are most common on stressed plants that have been weakened by cold, insects, drought conditions, nutritional imbalances or root rot. Rodents can also spread the pathogens.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Tools and process of recombinant DNA technology
Hours Required	01
Learning Objectives	Student will learn Tools and process of recombinant DNA technology
Previous Knowledge to be reminded	Vectors and competitive host
Examples/Illustrations	Plasmid, cosmids
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz, student seminars
Activities planned outside the class	nil
Any other activity	NIL
Synopsis	

### Restriction Enzymes

The restriction enzymes – help to cut, the polymerases- help to synthesize and the ligases- help to bind.

The restriction enzymes used to cut DNA. They are two types, namely endonucleases and exonucleases. The restriction endonucleases are sequence-specific which is usually palindrome sequences and cut the DNA at specific points.

### Vectors

The vectors help in carrying and integrating the desired gene. These form a very important part of the tools of recombinant DNA technology as they are the ultimate vehicles that carry forward the desired gene into the host organism. Plasmids and bacteriophages are the most common vectors in recombinant DNA technology.

### Host Organism

Host organism is the organism into which the recombinant DNA is introduced. The host is the ultimate tool of recombinant DNA technology which takes in the vector engineered with the desired DNA with the help of the enzymes. There are a number of ways in which this recombinant DNA's are inserted into the host, namely – microinjection, biolistics or gene gun, alternate cooling and heating, use of calcium ions, etc.

### Process of recombinant DNA technology

1. Isolating genetic material.
2. Cutting DNA fragments at specific locations.
3. Joining DNA fragments by ligation and homopolymer tailing.
4. Inserting DNA into the host cell.
5. Selecting and screening the transformed cells.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Applications of biotechnology
Hours Required	01
Learning Objectives	Student will learn Applications of biotechnology
Previous Knowledge to be reminded	r-DNA technology
Examples/Illustrations	Plasmid, Insulin, RNA silencing.
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	nil
Any other activity	NIL
Synopsis	

## Biotechnology Applications in Medicine

### Recombinant Insulin

Insulin is required by diabetic patients to remove excess sugar from the blood. Diabetic patients have a very low level of insulin or no insulin produced by the body. Therefore, they need external insulin to control blood glucose levels.

**Gene Therapy:** Genetherapy is used to treat genetic disorders usually by the insertion of a normal gene or correct gene for the defective or inactive gene into an individual with the help of vectors such as retrovirus, adenovirus, and herpes simplex virus.

**Molecular Diagnosis:** This can be achieved with the help of techniques such as Recombinant DNA Technology, PCR and Enzyme-Linked Immunosorbent Assay (ELISA), etc.

**Pharmacogenomics:** It can be applied in diseases such as cancer, depression, HIV, asthma, etc.

### Edible Vaccines

Vaccines are obtained by animals and cell cultures. These vaccines contain inactivated pathogens. Transgenic sugarbeet can treat foot and mouth disease of animals, transgenic banana and tomato can cure diseases such as cholera and hepatitis B.

Fermentation is an ancient invention of biotechnology. Alcohol and bread are being produced since ages with the help of microorganisms such as yeast. In today's scenario, the cultures have been purified and genetically refined to produce high-quality food products.

**Other uses:** Crop improvement by crossing the plant breeds with desired traits is another application of biotechnology in the agriculture sector.

Transgenic plants are genetically engineered to produce plants with desired characteristics.

Tissue culture is another application of biotechnology to produce a large number of plants with an explant. It also helps in increasing the number of endangered plant species.

It is also helpful in forensics for the identification of criminals, or in paternal disputes.

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Name of the Department/Subject	Botany
Name of the Lecturer	P. Sudhakar
Course/Group	BCom. BA
Paper	<b>Principles Of Biological Sciences</b>
Name of the Topic	Applications of biotechnology- transgenic animals.
Hours Required	01
Learning Objectives	Student will learn transgenic animals.
Previous Knowledge to be reminded	r-DNA technology
Examples/Illustrations	Transgenic animals.
Additional Inputs	Notes
Teaching Aids Used	Black board, laptop, ppt
References Cited	Telugu Akademi Books - Botany
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	nil
Any other activity	NIL
Synopsis	

### **Transgenic Animals**

#### **Dolly Sheep**

Dolly the sheep was the first mammal to be cloned from an adult cell. In this, the udder cells from a 6-year-old Finn Dorset white sheep were injected into an unfertilized egg from a Scottish Blackface ewe, which had its nucleus removed. The cell was made to fuse by electrical pulses. After the fusion of the nucleus of the cell with the egg, the resultant embryo was cultured for six to seven days.

#### **Transgenic Mice**

Transgenic mice are developed by injecting DNA into the oocytes or 1-2 celled embryos taken from female mice. After injecting the DNA, the embryo is implanted into the uterus of receptive females.

#### **Applications Of Transgenic Animals**

The transgenic animals are created because of the benefits they provide to the man. Let us discuss a few of them here.

#### **Normal Physiology and Development**

In transgenic animals, a foreign gene is introduced due to which the growth factor is altered. Hence, these animals facilitate the study of gene regulation and their effect on the everyday functions of the body.

#### **Study of Diseases**

Transgenic animals are specially designed to study the role of genes in the development of certain diseases. Moreover, in order to devise a cure for these diseases, the transgenic animals are used as model organisms. These transgenic models are used in research for the development of medicines. For example, we have transgenic models for diseases such as Alzheimer's and cancer.

**Biological Products:** A number of biological products such as medicines and nutritional supplements are obtained from transgenic animals. Research for the manufacture of medicines to treat diseases such as phenylketonuria (PKU) and hereditary emphysema is going on. The first transgenic cow, Rosie (1997), produced milk containing human protein (2.4 grams per litre). This milk contains the human gene alpha-lactalbumin and could be given to babies as an alternative to natural cow milk.

**Vaccine Safety:** Transgenic animals are used as model organisms for testing the safety of vaccines before they are injected into humans. This was conventionally done on monkeys.

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**DEPARTMENT OF BOTANY**



**2023-24**

**TEACHING NOTES**

**BOTANY MINER**

**Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)**

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

### 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.
- Fungi include eukaryotic, spore-bearing organisms with absorptive nutrition, no chlorophyll, and that reproduce sexually and asexually.
- Scientists who study fungi are mycologists, and the scientific discipline dealing with fungi is called mycology.
- Fungi are primarily terrestrial organisms, although a few are freshwater or marine.
- Many are pathogenic and infect plants and animals.
- Fungi also form beneficial relationships with other organisms. For example, about three-fourths of all vascular plants form associations (called mycorrhizae) between their roots and fungi.
- Ectomycorrhiza and endomycorrhiza
- Fungi also are found in the upper portions of many plants.
- These endophytic fungi affect plant reproduction and palatability to herbivores.
- Lichens are associations of fungi and either algae or cyanobacteria.
- Reproduce vegetatively by fragmentation and budding in yeast.
- Reproduce asexually by exospores , endospores, conidia etc. Asexual fruiting bodies are Sclerotia, Synnema etc.
- Reproduce sexually by gametic or gametangial fusion and produce zygosporangia, ascospores, basidiospores, oospores etc.
- Sexual fruiting bodies are ascocarp, basidocarp etc.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	FUNGI- GENERAL CHARACTERS
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,
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Field trip
Any other activity	Slip test
<b>Synopsis</b>	

Ainsworth proposed a more natural system of classification of fungi divided into two divisions: Myxomycota i.e., slime molds and Eumycota or true fungi.

• Divisions are subsequently divided into subdivision, class, subclass, order, family and then to genus.

**Division: Myxomycota** • Wall-less organisms possess either a Plasmodium or a pseudoplasmodium

1. Class. Acrasiomycetes (cellular slime molds): Amoeboid cells aggregating into a pseudoplasmodium

2. Class. Hydromyxomycetes (net slime molds): net plasmodium' or 'filo-plasmodium'.

3. Class. Myxomycetes (true slime molds): Free-living plasmodium, non-parasitic, fructification present. 4.

Class. Plasmodiophoromycetes (endo- parasitic slime molds): Plasmodium parasitic, no fructification

**Division Eumycota** (True fungi, all with walls)

**Subdivision Mastigomycotina** (motile cells – zoospores present, perfect state sporeospore).

1. Class. Chitridiomycetes (unicellular, zoospore with single whiplash flagellum).

2. Class. Hyphochytridiomycetes (uni-cellular, zoospore with single tinsel flagellum).

3. Class. Oomycetes (aseptate mycelium, zoospores with two flagella).

**Subdivision. Zygomycotina** (mycelium aseptate, perfect state spore-zygospore).

1. Class. Zygomycetes (mycelium immersed in the host tissue).

2. Class. Trichomycetes (mycelium not immersed in the host tissue). • Example: Rhizopus

**Subdivision. Ascomycotina:** perfect state spore ascospores formed in ascus, usually within ascocarp).

1. Class. Hemiascomycetes (no asco-carp, asci naked).

2. Class. Loculoascomycetes (fruit body an ascostroma, asci bitunicate i.e., 2-walled).

3. Class. Plectomycetes (fruit body cleistothecium, asci unitunicate i.e., 1-walled).

4. Class. Laboulbeniomycetes (fruit body perithecium, asci unitunicate, exoparasite of arthropods).

5. Class. Pyrenomycetes (fruit body perithecium, asci unitunicate, not parasitic on arthropods).

6. Class. Discomycetes (fruit body apothecium, asci unitunicate).

**Subdivision. Basidiomycotina** (yeast or septate mycelium, perfect state spore – basidiospore

1. Class. Teliomycetes. Basidiocarp lacking

2. Class. Hymenomycetes. Basidio- carp present. Hymenium is completely or partly exposed at maturity.

3. Class. Casteromycetes. Basidiocarp present. Hymenium enclosed in basidiocarp.

**Subdivision. Deuteromycotina** or Fungi imperfecti. Perfect state unknown.

1. Class. Blastomycetes. Budding , with or without pseudomycelium.

2. Class. Hyphomycetes. Mycelia sterile asexual spore directly or on conidiophores.

3. Class. Coelomycetes. Mycelial; asexual spore formed in pycnidium or acervulus.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	FUNGI- GENERAL CHARACTERS
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,
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Field trip
Any other activity	Slip test
<b>Synopsis</b>	

**Thallus Organization of Fungi:** body of fungi may be as simple as unicellular thallus or mycelia.

**1. Unicellular Thallus :** In some of the lower fungi such as the Chytrids and Yeasts, the thallus is more or less a spherical, single-celled structure . At the time of reproduction, it becomes a reproductive unit. Q. What is holocarpic fungi. Give an example.

**2.Mycelial Thallus :** show fluffy thallus of cottony mass and tubular structures called as hyphae. Collectively the hyphae intertwine to form the vegetative body of the fungi called mycelium. The hypha is thus a structural unit of the mycelium.

The fungal mycelium is of two types i) Aseptate ii) Septate

**i)Aseptate:** The protoplasm is continuous without being interrupted by cross walls i.e., lacks internal partition. They are multinucleated continuous mass of hyphae and are so called as Coenocytic. It grows terminally by the apical elongation. It is found in class Phycomycetes.

**ii)Septate:** Development of cross walls i.e., partitions during meiosis and mitosis as a result the hyphae becomes divided into cellular structure. They are uninucleate or multinucleate.

**Modifications of hyphae :** Organisation of the mycelium show seven types of modifications as follows

- 1. Plectenchyma :** A false tissue formed by aggregation of hyphae is known as Plectenchyma.
- 2. Rhizomorph:** A thick strand or root like aggregation of somatic hyphae is called Rhizomorph.
- 3. Sclerotium :** They are composed of pseudoparenchyma cells and stores food and outer cells are thick walled. Structurally rounded and cushion shaped tough and resting bodies. It may survive for long periods.
- 4. Stromata:** Any fungal tissue that forms reproductive structures are called Stromata.
- 5. Pseudosclerotium :** These sclerotia like bodies are formed at the base of fruit bodies of higher fungi.
- 6. Appressorium :** These are common in parasitic fungi mostly ectoparasites. An appressorium is a terminal simple or lobed swollen structure of germ tubes or infection hyphae.
- 7. Haustorium:** These are mostly produced as intracellular absorbing structures of obligate parasites. Haustoria are usually produced in those fungi in which intercellular mycelium are found. Haustoria also provide a greater surface area for the exchange of materials.

**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.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	FUNGI- GENERAL CHARACTERS
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,
Student Activity Planned after teaching	Interaction, quiz , student seminars
Activities planned outside the class	Field trip
Any other activity	Slip test
<b>Synopsis</b>	

### Heterothallism in Fungi:

A. F. Blakeslee, an American Geneticist, in 1904 made an important observation with *Mucor*, which resulted in the discovery of Heterothallism.

Blakeslee observed, that while some isolates of *Mucor* formed sporangia as well as zygospores (e.g., *M. tenuis*), some others failed to form the zygospores and reproduced only by sporangiospores. When he grew these non-sexually reproducing isolate with other similar isolates, zygospores appeared in the region where the hyphae of the different isolates came in contact with each other.

Blakeslee coined the terms homothallism and heterothallism to explain this phenomenon. The homothallic species were those that produced zygospores independently, while heterothallic species required the presence of the opposite mating type.

*M. hiemalis*, *M. mucedo*, *Rhizopus nigricans* are examples of heterothallic species. Since the two mating types were morphologically indistinguishable, Blakeslee designated them as the (+) and (-) mating types or strains (not male or female).

### Parasexuality in Fungi:

A similar alternative to sexual reproduction was discovered in the imperfect fungus, *Aspergillus nidulans*, in 1952 by Pontecorvo and Roper of Glasgow.

They called this parasexual cycle. In this, genetic recombination occurs in somatic cells by the mechanism of mitotic crossing over, which brings the same result as is achieved by the meiotic crossing over.

#### The parasexual cycle involves the following steps:

1. Formation of heterokaryotic mycelium.
2. Nuclear fusions and multiplication of the diploid nuclei.
3. Mitotic crossing over during division of the diploid cells.
4. Sorting out of the diploid strains.
5. Haplodization.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	Rhizopus- life cycle.
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	Mucor, Rhizopus stolonifer
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
<b>Synopsis</b>	<p>1. Common fungi growing on stale bread, therefore, also called Bread mould.</p> <p>2. Lives as a saprophytes</p> <p><b>Structure of thallus:</b></p> <p>1. The fungus consists of white cottony, much branched mycelium.</p> <p>2. The mycelium has three types of hyphae 1. Stolans 2. Rhizoids 3. Sporangiosphore.</p> <p>3. Cell wall is chitinous.</p> <p>4. The mycelium is aseptate and coenocytic.</p> <p>Reproduction in Rhizopus:</p> <p>Rhizopus reproduces by vegetative, asexual and sexual mode.</p> <p>1. Vegetative reproduction: It takes by fragmentation.</p> <p>2. Asexual reproduction: By means of</p> <p>(a) sporangiospore and (b) chlamydo spores</p> <p><b>(a) sporangiospores formation:</b></p> <p>During favourable condition, the non-motile spores such as sporangiospores or aplanospores are formed inside the sporangium.</p> <p><b>(b) Chlamydo spore:.</b></p> <p>During unfavourable condition mycelium produce chlamydo spores.</p> <p><b>2. Sexual reproduction:</b></p> <p>Most of the species of Rhizopus are heterothallic (Rhizopus. stolonifer), but few species (R. sexualis) are homothallic.</p> <p>3. In heterothallic species, zygo spores are produced by the union of two gametangia developed from mycelia of compatible strains</p> <p>5. The heterothallic species are cultured, two mycelia of compatible strain come near to each other, the mycelia produce small outgrowth, called progametangia.</p>

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	Rhizopus- life cycle.
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	Mucor, Rhizopus stolanifer
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	

Phytophthora species attack higher plants, mostly angiosperms and cause diseases of economic significance. One of the most common and well known species of Phytophthora is P. infestans, causing the disease called late blight of potato or Potato blight.

**Symptoms of Phytophthora :**

The disease appears as small black or purplish black areas at the margins and tips of the leaf . • These patches gradually enlarge and soon the entire crown may rot. • Under favourable conditions all parts of the host undergo browning and rotting.

**Vegetative structure:** It is profusely branched and consists of aseptate, hyaline, profusely branched, coenocytic. The fungus spreads through tissues of leaves, stems and tubers. There are intercellular and intracellular hyphae formed into the living cell.

**Asexual Reproduction :** The special branched aerial hyphae are called sporangiophores (conidiophores). • The sporangium is formed by the inflation of the tip of the side branch of the sporangiophore • The sporangia are, thus, borne terminally but are subsequently shifted to a lateral position

**Sexual Reproduction :** In Phytophthora sexual reproduction is oogamous. Antheridium and Oogonium are sex organs

**Fertilization :** The intervening walls between the antheridium and the oogonial stalk at the point of contact (Plasmogamy). • The functional male travels through the fertilization tube and fertilized with the female nuclei (Karyogamy). The fertilized cell is called Oospore (2n).

**Oospore germination** takes place after the decay of the host tissues and on the onset of conditions suitable for germination. Germination of oospore During the pregermination stage Phytophthora oospore absorbs water and swell.

The diploid oospore nucleus divides meiotically and later on successive divisions result in the formation of few or many nuclei in the oospore.. The exospore cracks and the endospore comes out in the form of a germ tube which develops a sporangium at the tip.

The contents of sporangium may divide to form zoospores (Fig. 10 K) or sometimes may directly develop into a mycelium (P. cactorum). The germ tube in P. infestans usually ends in a terminal papillate germ sporangium typical of the species in methods of germination. Thus, it completes its life cycle only within its host tissue.

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<b>Name of the Department/Subject</b>	<b>BOTANY</b>
<b>Name of the Lecturer</b>	<b>P. SUDHAKAR</b>
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	Rhizopus- life cycle.
<b>Hours Required</b>	2
<b>Learning Objectives</b>	Illustrate the diversity of fungi, Classify fungi Analyze and ascertain the plant diseases by fungi Evaluate the ecological and economic value of fungi
<b>Previous Knowledge to be reminded</b>	Whittaker five kingdom classification.
<b>Examples/Illustrations</b>	Mucor, Rhizopus stolanifer
<b>Additional Inputs</b>	heterothallism
<b>Teaching Aids Used</b>	Black board, laptop, ppt
<b>References Cited</b>	1.Telugu Akademi - Botany -1, 3. Fungi- Text first degree students by B.R. Vashista&A.K. Sinha
<b>Student Activity Planned after teaching</b>	Interaction, quiz , student seminars
<b>Activities planned outside the class</b>	Field trip
<b>Any other activity</b>	Slip test
<b>Synopsis</b>	
<p><b>Penicillium</b> is a genus of saprophytic (feeding on dead and decaying materials) fungi.</p> <p>They are commonly known as blue or green mould.</p> <p>They are economically important for the production of cheese, organic acids and antibiotics.</p> <p>They play an important role as a decomposer in the ecosystem.</p> <p>Penicillium can be found at various places such as soil, air, on decaying food, etc. <b>Penicillin</b> is one of the most important antibiotics extracted from Penicillium sp.</p> <ul style="list-style-type: none"> <li>• The vegetative structure of Penicillium is a multicellular mycelium</li> <li>• The mycelium is made up of highly branched, multinucleated and septate long thread-like filamentous structure known as hyphae</li> <li>• The cell wall is made up of a glucose polysaccharide and chitin</li> <li>• The cytoplasmic continuity is maintained through central pore, present in the septa</li> <li>• Conidiophores are present at the branch ending along with spherical conidiospores, which are asexual spores produced exogenously</li> <li>• Conidia are produced in the basipetal succession, i.e. the youngest conidium is present at the base</li> <li>• Conidia are produced from the specialised cells called phialide, present in the group and give a brush-like appearance to the fungus</li> <li>• Ascospores are found in asci arranged in ascocarps, which are sexual spores produced endogenously.</li> <li>• Ascocarp is cleistothecium.</li> <li>• Some of the mycelia grow deeper into the substratum to derive food</li> <li>• The food is stored in the form of oil globules</li> </ul>	

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	Fungi- Puccinia Life Cycle.
Hours Required	2
Learning Objectives	Illustrate the diversity of fungi Analyze and ascertain the plant diseases by Puccinia Evaluate the ecological and economic value of Puccinia
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 barberry
2. Stage 1 – aecial stage – produced on barberry
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 uredospores in 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 germinate in situ to produce the basidial stage in the life cycle. . Karyogamy and meiosis takes place in teliospores to give rise haploid, uninucleated basidiospores.

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

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
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
<b>Synopsis</b>	

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

#### Characteristics of Lichens:

Based on the morphological structure of thalli, they are of three types crustose, foliose and 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 different animals like snail, caterpillars, 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 or astringent 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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	ALGAE – GENERAL CHARACTERS.
<b>Hours Required</b>	2 HOURS
<b>Learning Objectives</b>	Illustrate the diversity of Algae Evaluate the ecological and economic value of Algae
<b>Previous Knowledge to be reminded</b>	Whittaker five kingdom classification
<b>Examples/Illustrations</b>	Spirogyra , Polysiphonia etc.,
<b>Additional Inputs</b>	SCP
<b>Teaching Aids Used</b>	BLACK BOARD, LAPTOP, CHART
<b>References Cited</b>	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND & COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
<b>Student Activity Planned after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
<b>Activities planned outside the class</b>	FIELD VISIT
<b>Any other activity</b>	NIL
<b>Synopsis</b>	<p>GENERAL CHARACTERISTICS OF ALGAE</p> <p><b>Pant body:</b> known as Thallus and they are non-vascular</p> <p><b>Habitat:</b> Algae are usually aquatic, either freshwater or marine and some are terrestrial.</p> <p><b>Cell structure:</b> Algae show eukaryotic cell structure. Cell wall made up of cellulose and other polysaccharides. Chloroplasts are of different shapes. In chlorophyceae members pyrenoids are present. Stigma is eye spot present as light receptive organ in motile cells.</p> <p><b>Storage form of food:</b> Starch</p> <p><b>Pigments:</b> Chlorophyll a, chlorophyll b, chlorophyll c, chlorophyll d, chlorophyll e. Xanthophyll, Carotenes. Phycobilins: Phycocyanins and phycoerythrin.</p> <p><b>Flagella:</b> 9+2 arrangement. Variable in number and nature.</p> <p><b>Reproduction:</b> Vegetative method: Asexual spore: zoospores, aplanospores, hypnospores, akinetes etc. Sexual method: isogamous, anisogamous, and oogamous gametic fusion. Meiosis occurs at zygotic stage. Do not form embryo.</p> <p>Life cycles: 1. Haplontic life cycle –Ex: Spirogyra</p> <ol style="list-style-type: none"> <li>1. Diplontic life cycle: Diatoms, Fucus</li> <li>2. Diplobiontic life cycle: Polysiphonia</li> <li>3. Haplobiontic life cycle: Batrachospermum.</li> <li>4. Haplodiplontic life cycle: Ectocarpus.</li> </ol>

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	ALGAE – Thallus organisation
<b>Hours Required</b>	2 HOURS
<b>Learning Objectives</b>	Illustrate the diversity of Algae Evaluate the ecological and economic value of Algae
<b>Previous Knowledge to be reminded</b>	Whittaker five kingdom classification
<b>Examples/Illustrations</b>	Spirogyra , Polysiphonia etc.,
<b>Additional Inputs</b>	SCP
<b>Teaching Aids Used</b>	BLACK BOARD, LAPTOP, CHART
<b>References Cited</b>	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND & COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
<b>Student Activity Planned after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
<b>Activities planned outside the class</b>	FIELD VISIT
<b>Any other activity</b>	NIL
<b>Synopsis</b>	

### Thallus organization:

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

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

### 2. Multicellular Form

#### A. Colonial Aggregation:

##### i. Coenohium

##### ii. Palmelloid:

##### iii. Dendroid:

##### iv. 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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	ALGAE – CLASSIFICATION.
<b>Hours Required</b>	1HOURS
<b>Learning Objectives</b>	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
<b>Previous Knowledge to be reminded</b>	Whittaker five kingdom classification
<b>Examples/Illustrations</b>	Spirogyra , Polysiphonia etc.,
<b>Additional Inputs</b>	SCP
<b>Teaching Aids Used</b>	BLACK BOARD, LAPTOP, CHART
<b>References Cited</b>	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND & COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
<b>Student Activity Planned after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
<b>Activities planned outside the class</b>	NIL
<b>Any other activity</b>	NIL
<b>Synopsis</b>	<p>The primary classification of algae is based on certain morphological and physiological features . These are...</p> <ul style="list-style-type: none"> <li>• Pigment composition</li> <li>• Chemical nature of reserve food</li> <li>• Kind, no., point of insertion and relative length of flagella</li> <li>• Presence or absence of a definite nucleus</li> </ul> <p>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 of Algae” in two volumes. He classified algae into 11 classes. These are---</p> <ol style="list-style-type: none"> <li>1. Chlorophyceae (green algae)</li> <li>2. Xanthophyceae (Yellow-green algae)</li> <li>3. Chrysophyceae</li> <li>4. Bacillariophyceae (Diatoms)</li> <li>5. Cryptophyceae</li> <li>6. Dinophyceae (Dinoflagellates)</li> <li>7. Chloromonadineae</li> <li>8. Euglenophyceae</li> <li>9. Phaeophyceae (Brown algae)</li> <li>10. Rhodophyceae ( Red algae)</li> <li>11. Myxophyceae (blue green algae)</li> </ol> <p>Merits: Demerits:</p>

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	ALGAE – Ecological and economic importance of algae.
<b>Hours Required</b>	2 HOURS
<b>Learning Objectives</b>	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
<b>Previous Knowledge to be reminded</b>	Whittaker five kingdom classification
<b>Examples/Illustrations</b>	Spirogyra adnataetc,
<b>Additional Inputs</b>	Conjugation in Bacteria.
<b>Teaching Aids Used</b>	BLACK BOARD, LAPTOP, CHART
<b>References Cited</b>	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND &COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
<b>Student Activity Planned after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR, QUIZ.
<b>Activities planned outside the class</b>	Field visit
<b>Any other activity</b>	NIL
<b>Synopsis</b>	

### Economic Importance of Algae

#### 1. Algae as Food:

Algae have been in use as human food for centuries in various parts of the World. 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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	ALGAE – SPIROGYRA LIFE CYCLE
<b>Hours Required</b>	2 HOURS
<b>Learning Objectives</b>	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
<b>Previous Knowledge to be reminded</b>	Whittaker five kingdom classification
<b>Examples/Illustrations</b>	Spirogyra adnataetc,
<b>Additional Inputs</b>	Conjugation in Bacteria.
<b>Teaching Aids Used</b>	BLACK BOARD, LAPTOP, CHART
<b>References Cited</b>	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND & COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
<b>Student Activity Planned after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR, QUIZ.
<b>Activities planned outside the class</b>	Field visit
<b>Any other activity</b>	NIL
<b>Synopsis</b>	

**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 possesses pyrenoids.

**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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	ALGAE –Ectocarpus
<b>Hours Required</b>	2 HOURS
<b>Learning Objectives</b>	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
<b>Previous Knowledge to be reminded</b>	Whittaker five kingdom classification
<b>Examples/Illustrations</b>	Polysiphonia
<b>Additional Inputs</b>	SCP, USE OF MARINE ALGAE.
<b>Teaching Aids Used</b>	BLACK BOARD, LAPTOP, CHART
<b>References Cited</b>	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND & COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
<b>Student Activity Planned after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
<b>Activities planned outside the class</b>	NIL
<b>Any other activity</b>	NIL
<b>Synopsis</b>	

**Habitat:** Grow as epiphytes on other organisms or on rocky substrates. Mostly marine.

**Structure of *Ectocarpus*:** The thallus of *Ectocarpus* is profusely branched with uniseriate heterotrachous filaments, such that it consists of both prostrate and erect branches. The prostrate branches have irregularly branched filaments and remain attached to the substratum with the help of rhizoids. The cells of the filament are rectangular or cylindrical in shape and uninucleate in nature. The cell wall is thick and is composed of pectin and cellulose. The presence of pigment fucoxanthin gives the alga its characteristic brown colour.

**Reproduction:** *Ectocarpus* undergoes both sexual and asexual reproduction.

### Asexual Reproduction

Asexual reproduction in *Ectocarpus* takes place by biflagellated zoospores that are produced in both unilocular and plurilocular sporangia. While unilocular sporangia give rise to haploid zoospores, plurilocular sporangia form diploid zoospores. The plurilocular sporangia plays no role in alternation of generation.

### Sexual Reproduction

Sexual reproduction in *Ectocarpus* is either isogamous or anisogamous. Most of the species are isogamous and homothallic, while some are anisogamous and heterothallic.

The gametes are produced in plurilocular gametangia. The gametes fuse to form a diploid zygote. The zygote does not undergo meiotic divisions but rather develops into a diploid sporophyte that bears unilocular and plurilocular sporangia.

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	ALGAE – Vaucheria
<b>Hours Required</b>	2 HOURS
<b>Learning Objectives</b>	Illustrate the diversity of Algae. Classify Algae Evaluate the ecological and economic value of Algae
<b>Previous Knowledge to be reminded</b>	Whittaker five kingdom classification
<b>Examples/Illustrations</b>	Polysiphonia
<b>Additional Inputs</b>	SCP, USE OF MARINE ALGAE.
<b>Teaching Aids Used</b>	BLACK BOARD, LAPTOP, CHART
<b>References Cited</b>	TELUGU ACADEMY BOOK, A TEXT BOOK OF MICROBIOLOGY, S CHAND & COMPANY LTD. STRUCTURE AND REPRODUCTION IN ALGAE By Fritsch
<b>Student Activity Planned after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
<b>Activities planned outside the class</b>	NIL
<b>Any other activity</b>	NIL
<b>Synopsis</b>	

### Structure of *Vaucheria*

The plant body of *Vaucheria* is filamentous, branched, coenocytic, and siphonaceous thallus. It has an outer layer made of pectin and an inner layer made up of cellulose. It contains pigments, such as chlorophyll a, chlorophyll e, xanthophylls and carotenoids. Food is stored in the form of oil and can be seen as colourless droplets in the cytoplasm.

### Reproduction :

#### Vegetative Reproduction

Vegetative reproduction in *Vaucheria* takes place by fragmentation.

#### Asexual reproduction:

1. Aplanospores: Aplanospores are non-motile spores
2. Zoospores: compound zoospores.
3. Akinetes: Akinetes are during unfavourable conditions.

**Sexual Reproduction:** Sexual reproduction in *Vaucheria* is of oogamous type. The male sex organ is known as antheridium, and the female sex organ is known as oogonium. The plant body of *Vaucheria* can either be homothallic.

**Fertilisation:** At the time of fertilisation, the beak of the oogonium ruptures, and an aperture is formed in the antheridium. The antherozoids lose their flagella upon coming in contact with the ovum and fuse with it to form a diploid zygote.

#### Germination

The zygote divides meiotically and mitotically to form a coenocytic structure. The zygote wall cracks at some point, and the protoplasm elongates to give rise to rhizoidal initial and aerial hyphae.

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

**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.

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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Principal

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

### **Economic Importance of Algae**

#### **1. Algae as Food:**

Algae have been in use as human food for centuries in various parts of the World. 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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	Cultivation of Chlorella
<b>Hours Required</b>	2
<b>Learning Objectives</b>	<ol style="list-style-type: none"><li>1. Illustrate the diversity of food resources.</li><li>2. Evaluate the ecological and economic value of Chlorella</li></ol>
<b>Previous Knowledge to be reminded</b>	SCP
<b>Examples/Illustrations</b>	Spirulina, Yeast, Agaricus...
<b>Additional Inputs</b>	Microscopic slides showing.
<b>Teaching Aids Used</b>	Charts, Black board, laptop, projector.
<b>References Cited</b>	<ol style="list-style-type: none"><li>1. Botany-1: Telugu Akademi, Hyderabad.</li><li>2. Pandey, B.P. - College Botany, Volume-I, S. chand publishing.</li></ol>
<b>Student Activity Planned after teaching</b>	Interaction, Quiz, Student seminars & Slip test.
<b>Activities planned outside the class</b>	Nil
<b>Any other activity</b>	Nil
<b>Synopsis</b>	<p>It is unicellular, non-motile alga belongs to Chlorophyceae. Chlorella has a high quality food value and its nutritional value has been compared with soya bean and spinach leaves. It contains 50% protein and 20% lipids and carbohydrates. Proteins of Chlorella have all amino acids essential for nutrition of human and animals. These amino acids are comparable with animal proteins which lack methionine and are fairly rich in pro-Vitamin-A, Vitamin-C, Riboflavin, Biotin, pantothenic acid, Niacin, Thiamine, Vitamine-K, Vitamin-B12, Chlorine, inositol, Para-amino benzoic acid, Pyridine etc.</p> <p>Such algal proteins can be used to supplement cereal preparation. Chlorella has also been used as food by astronauts in space flights.</p> <p>Mass scale culturing of Chlorella:</p> <p>This alga can grow easily in sun light and in artificial light in the presence of CO<sub>2</sub> and nutrients in culture medium. The mass culturing of Chlorella is handicapped due to the following reasons.</p> <ol style="list-style-type: none"><li>1. High cost equipments and nutrients.</li><li>2. Need for preventing contamination during preparation of culture and growth of alga.</li><li>3. Maintenance and labor cost per one unit of production.</li><li>4. Culturing places can only be made in open sunny, warm and semi desert areas.</li></ol> <p><b>Cultivation:-</b></p> <p>The idea of mass culturing of Chlorella originated due to its fast growth, high nutritional value, simple growth requirements and formation of little waste materials. The alga during cultivation utilizes organic wastes as fertilizers and produces a variety of products (chemicals and antibiotics).</p> <p><b>YIELD:</b> Average mass scale yield rate of Chlorella varies from 45 to 70 metric tons per hectare per year and in terms of proteins about 20-40 metric per hectare per year.</p> <p><b>Harvesting and Drying:-</b></p> <p>After mass culturing of the algal cells are collected and washed properly. Now they are dried in vacuum and the ground in the mill to form powdery flour. It should be kept in the mind that such algal preparations must be acceptable as human food. Efforts are further in progress to remove the above</p>

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BSC(Zoology Major)
<b>Paper</b>	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
<b>Name of the Topic</b>	General characters of Bryophytes
<b>Hours Required</b>	2
<b>Learning Objectives</b>	<ol style="list-style-type: none"><li>3. Illustrate the diversity of Bryophytes</li><li>4. Classify Bryophytes</li><li>5. Evaluate the ecological and economic value of Bryophytes</li><li>6. Understand the evolution of sporophyte in Bryophytes</li></ol>
<b>Previous Knowledge to be reminded</b>	Moss plants, amphibians of plant kingdom.
<b>Examples/Illustrations</b>	Marchatia, Anthoceros, polytrichum, Funaria.
<b>Additional Inputs</b>	Microscopic slides showing.
<b>Teaching Aids Used</b>	Charts, Black board, laptop, projector.
<b>References Cited</b>	<ol style="list-style-type: none"><li>3. Botany-1: Telugu Akademi, Hyderabad.</li><li>4. Pandey, B.P. - College Botany, Volume-I, S. chand publishing.</li></ol>
<b>Student Activity Planned after teaching</b>	Interaction, Quiz, Student seminars & Slip test.
<b>Activities planned outside the class</b>	Nil
<b>Any other activity</b>	Nil
<b>Synopsis</b>	<p>General characteristics of Bryophyta</p> <ol style="list-style-type: none"><li>1. The plant body is a gametophyte.</li><li>2. They grow in areas which are in between the aquatic and terrestrial habitats i.e. amphibious zone and hence known as amphibious plants.</li><li>3. They have thalloid or leafy multicellular green plant body.</li><li>4. The plant body lacks true roots, stem or leaves.</li><li>5. The plants are green and possess chloroplasts.</li><li>6. They show autotrophic mode of nutrition.</li><li>7. Vascular tissues are completely absent.</li><li>8. Sexual reproduction is oogamous.</li><li>9. Male reproductive organ is antheridium. It produces biflagellate male antherozoids.</li><li>10. The female sex organ is archegonium. It has egg cell in its venter.</li><li>11. Water is essential for fertilization.</li><li>12. these are first land plants.</li><li>13. plant body is completely parenchymatous.</li><li>14. they are of little economic important.</li></ol> <p>Classification: 3 classes</p> <ol style="list-style-type: none"><li>1. Hepaticopsida- liverworts</li><li>2. Anthocerotopsida- hornworts</li><li>3. Bryopsida- mosses</li></ol>



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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	Rothmaler classification of Bryophytes.
Hours Required	2 HOURS
Learning Objectives	Illustrate the diversity of Bryophytes Classify 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	

## Classification of Bryophytes

According to the latest classification, Bryophyta is divided into three classes:

- A. Hepaticopsida (Liverworts)
- B. Anthocerotopsida (Hornworts)
- C. Bryopsida (Mosses)

A. Hepaticopsida (Liverworts): The name hepaticopsida comes from the word “hepatic” meaning liver. Liverworts come under this class.

Hepaticopsida is further divided into 4 orders:

1. Marchantiales (e.g. Riccia, Marchantia)
2. Sphaerocarpaceae (e.g. Sphaerocarpos)
3. Calobryales (e.g. Calobryum)
4. Jungermanniales (e.g. Pellia)

B. Anthocerotopsida (Hornworts): There are around 300 species present in this class. They are commonly known as hornworts. It has only one order i.e. Anthocerotales. Examples: Anthoceros, Megaceros, Notothylas.

Bryopsida is further divided into 5 orders:

1. Bryales
2. Andreales
3. Sphagnales
4. Polytrichales
5. Buxbaumiales



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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	Marchantia – morphology and anatomy
Hours Required	2 HOURS
Learning Objectives	Evaluate the ecological and economic value of Marchantia 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	3. Botany-1: Telugu Akademi, Hyderabad. 4. 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 into 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 layers 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	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	Marchantia – Reproduction.
Hours Required	2 HOURS
Learning Objectives	Illustrate the diversity of Bryophytes Evaluate the ecological and economic value of Marchantia Understand the evolution of sporophyte in Marchantia
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 consist 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	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
Name of the Topic	Anthoceros – morphology, anatomy and reproduction.
Hours Required	2 HOURS
Learning Objectives	Evaluate the ecological and economic value of Anthoceros Understand the evolution of sporophyte in Anthoceros
Previous Knowledge to be reminded	Moss plants, amphibians of plant kingdom.
Examples/Illustrations	Marchatia, Anthoceros, polytrichum, Funaria.
Additional Inputs	Evolutionary importance of Anthoceros
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	
<i>Anthoceros</i> is a hornwort that belongs to the family Anthocerotaceae. The gametophytic plant body is	

dorsiventral, thalloid, prostrate and dark green in colour. The thallus is either pinnately branched or bilobed with a large number of spongy bodies called gemma.

The dorsal surface of the thallus is mostly smooth but it may be velvety because of the presence of lamellae or it can be rough because of spines and ridges.

The ventral surface has unicellular rhizoids are present. Small blue-green colonies of *Nostoc* are present as a symbiotic relationship with *Anthoceros*.

Vegetative reproduction in *Anthoceros* takes place by the following means:

**Fragmentation: Tubers:** Tubers are structures that remain inactive during unfavourable conditions.

**Persistent Apices**

**Apospory:** In apospory, diploid gametophytic spores are directly formed from sporophytes. Sexual reproduction is of oogamous type in *Anthoceros*. The male and female sex organs are antheridia and archegonia, respectively. Both monoecious and dioecious species are found.

**Fertilisation**

The antherozoids swim in water and reach the mature archegonium. They pass through the mucilaginous neck cells and one of the antherozoids fuses with the egg to form a diploid zygote that gives rise to a sporophyte.

**The sporophytic body** of *Anthoceros* grows embedded in the gametophytic body. It is divided into three distinct regions: 1. Foot 2. Intercalary Zone 3. Capsule with Columella and Sporogenous Tissue.

**The spore** is haploid, uninucleate and semicircular in shape with a prominent triradiate mark. The spore consists of two walls: the outer wall is thick and ornamented, known as exospore and the inner wall is thin, known as endospore.

The spores germinate under favourable conditions by absorbing water. The outer layer (exospore) ruptures at the triradiate mark and the endospore comes out in the form of a tube, called germ tube.

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Name of the Department/Subject	BOTANY
Name of the Lecturer	P. SUDHAKAR
Course/Group	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
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	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
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

**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 biflagellated.

**Archegonia:** They are flask shaped, developed on archegoniophore. Archegoniophore bears archegonia, paraphyses and protected by perichaetial 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 apophysis- photosynthetic zone, theca - fertile part and operculum. Capsule has spore sac and spore 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	BSC(Zoology Major)
Paper	Non-Vascular Plants (Algae, Fungi, Lichens and Bryophytes)
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	Marchantia, 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 like Funaria, Polytrichum etc.

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# PRR & VS GOVT.DEGREE COLLEGE,

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DEPARTMENT OF BOTANY



2023-24

**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	Archaeobacteria , 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	<p><b>Cell theory:</b> proposed by schleiden and schwann</p> <ol style="list-style-type: none"> <li>1. All organisms are made up of cells</li> <li>2. All metabolic activities takes place in cells</li> <li>3. Cells do not form spontaneously.</li> <li>4. Cells are formed from preexisting cells.</li> </ol> <p><b>Prokaryotic cell:</b></p> <ol style="list-style-type: none"> <li>1. Well defined nucleus and membrane bound cell organelle absent.</li> <li>2. Cell wall: made by peptidoglycan and mucopolymers.</li> <li>3. Cell membrane: mesosomes are respiratory structures and help in binary fission.</li> <li>4. 70 s ribosomes are present. Organized into polysomes.</li> <li>5. Naked DNA is present at nucleoid region.</li> <li>6. Plasmid is self-replicative additional DNA</li> <li>7. Flagella do not show 9+2 arrangement.</li> <li>8. Sex pili help in conjugation.</li> <li>9. Histones are absent.</li> </ol> <p>Example: Bacteria, Cyanobacteria</p> <p><b>Eukaryotic cell:</b></p> <ol style="list-style-type: none"> <li>1. Well defined nucleus and membrane bound cell organelle are present.</li> <li>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.</li> <li>3. Cell organelle : <ol style="list-style-type: none"> <li>a) Chloroplast: b) Mitochondria</li> <li>c) Endoplasmic reticulum: d) Golgi apparatus etc.,</li> </ol> </li> </ol>

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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	Archaeobacteria , 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
<b>Synopsis</b>	
<p>Cell wall is outer most protective layer in plants but absent in animals. Cell wall synthesized by protoplasm.</p> <p><b>Cell wall structure:</b></p> <ol style="list-style-type: none"> <li><b>Middle lamella:</b> cement layer, made up of calcium and magnesium pectates.</li> <li></li> <li><b>Primary cell wall:</b> cellulose, hemicellulose, pectin and other polysaccharides. Elastic in nature.</li> <li><b>Secondary cell wall:</b> present in mature cells. Made up of lignin, suberin, pectin, tannins, wax etc. it has S1, S2, S3 layers.</li> </ol> <p><b>Growth of cell wall:</b></p> <ol style="list-style-type: none"> <li>Intussusception: micro fibrils filling the blanks of existing cell wall. Surface area increased.</li> <li>Opposition: micro fibrils deposit on surface of existing cell wall. Thickness of wall increased.</li> </ol> <p><b>Pits :</b></p> <ol style="list-style-type: none"> <li><b>Primary pits:</b> present in primary wall. Allow plasmadesmata through them.</li> <li><b>Secondary pits:</b> present in secondary wall. These are two types <ol style="list-style-type: none"> <li>Simple pits:</li> <li>Bordered pits:</li> </ol> </li> </ol>	

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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	Archaeobacteria , 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
<b>Synopsis</b>	
<p>The membrane surrounding cytoplasm in all cells is called plasma membrane. It is made up proteins and lipids.</p> <p><b>Chemistry of membrane:</b></p> <ol style="list-style-type: none"> <li>Made up of proteins and lipids. Present in 1: 0.8 to 1: 4. 75 A in thickness.</li> <li><b>Lipids:</b> are phospholipids, glycolipids and sterols.</li> <li>Phospholipids are bipolar in nature having hydrophilic head made by phosphate and hydrophobic tail made by fatty acids.</li> <li>Phospholipids are lecithin, choline and cephalin.</li> <li>Glycolipids have sugar, fatty acids and spingosine.</li> <li>Sterols are present in animal cells.</li> <li><b>Proteins:</b>3 types 1. Structural 2. Functional- enzymes 3. Carrier proteins. Based on position 1. Extrinsic and 2. Intrinsic proteins.</li> </ol> <p><b>Ultra structure of plasma membrane- models:</b></p> <ol style="list-style-type: none"> <li><b>Lipid bilayer model:</b> proposed by Gorter and Grendel.</li> <li><b>Daveson- Daniel model:</b></li> <li><b>Unit membrane model:</b> proposed by Robertson.</li> <li><b>Fluid-mosai model:</b>proposed by Singer and Nicolson.</li> <li><b>Micellar model:</b> proposed by Hoffmann and Hilleir.</li> </ol> <p><b>Functions:</b> 1. Compartmentalization 2. Selectively permeable. 3.Transport mechanism.</p> <ol style="list-style-type: none"> <li>Responding stimuli.</li> <li>Co-ordination.</li> </ol>	

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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	Archaeobacteria , 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:

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

### 2. Organization DNA in a chromosome – Nucleosome concept:

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

### 2. Euchromatin and heterochromatin:

- Euchromatin is uncondensed light coloured and active DNA.
- Heterochromatin is condensed thick coloured and inactive DNA.

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

### **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
<b>Synopsis</b>	
<p>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.</p> <p>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.</p> <p>The A and G are purines and the C and T are pyrimidines.</p> <p>Nucleotides connected by phosphodiester bonds to a DNA strand.</p> <p>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.</p> <p>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.</p> <p>The DNA coils up, forming <a href="#">chromosomes</a>, 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.</p> <p><b>Chargaff's Rule</b></p> <p><b>Erwin Chargaff</b>, a biochemist, discovered that the number of <b>nitrogenous bases in the DNA</b> was present in equal quantities. The amount of A is equal to T, whereas the amount of C is equal to G.</p> <p style="text-align: center;">In all organisms should have a 1:1 ratio of purine and pyrimidine bases. <b>A=T; C=G</b></p>	

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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 replication.
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 to 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

- Cross between Red eyed female ( $Xw+ Xw+$ ) and white eyed male ( $Xw Y$ )*
- 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
<b>Synopsis</b>	

**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
<b>Synopsis</b>	

**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
<b>Synopsis</b>	

#### 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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	Cell Biology, Genetics and Plant breeding
<b>Name of the Topic</b>	Methods of crop improvement- selection
<b>Hours Required</b>	4
<b>Learning Objectives</b>	Student will learn Methods of crop improvement-selection.
<b>Previous Knowledge to be reminded</b>	Mendelian inheritance
<b>Examples/Illustrations</b>	Monohybrid cross, dihybrid cross
<b>Additional Inputs</b>	Chromosomal maps
<b>Teaching Aids Used</b>	Black board, laptop
<b>References Cited</b>	1.Telugu Akademi - Botany 2. Genetics by B.D. Singh 3. Introduction to plant plant breeding by Chaudary
<b>Student Activity Planned after teaching</b>	Interaction.
<b>Activities planned outside the class</b>	Home work on chromosomal maps.
<b>Any other activity</b>	Nil
<b>Synopsis</b>	
<p><b>Selection in Self-Pollinated Crops</b> 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.</p> <p><b>Pureline Selection:</b> The concept of pureline was proposed by Johannsen on the basis of his studies with beans (<i>Phaseolus vulgaris</i>) 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.</p> <p><b>Characteristics of purelines</b></p> <ol style="list-style-type: none"> <li>1. All plants within a pure line have the same genotype.</li> <li>2. The variation with in a pureline is environmental and nonheritable.</li> <li>3. Purelines become genetically variable with time due to natural hybridization, mutation and mechanical mixture</li> </ol> <p><b>General steps for making a pureline selection</b></p> <p><b>First Season:</b> From the base population select best looking plants having the desirable characters. Harvest them on single plant basis.</p> <p><b>Second Season:</b> The selected single plants are grown in progeny rows and estimate the performance. Reject unwanted progenies.</p> <p><b>Third Season:</b> Repeat the process of second season.</p> <p><b>Fourth Season:</b> Grow the selected single plants in replicated preliminary yield trial along with suitable check or control variety.</p> <p><b>Fifth Season:</b> Conduct regular comparative yield trial along with check variety and select the best culture.</p> <p><b>Sixth Season:</b> Conduct multilocation trial in different research stations along with local check. <b>Seventh Season:</b> Conduct Adaptive Research Trial in farmer's field. Fix the best yielder and release it as a variety thro' Variety Release committee.</p> <p><b>Advantage of pureline selection.</b></p> <ol style="list-style-type: none"> <li>1.Achieves maximum possible improvement over the original variety. 2. Extremely uniform in appearance.</li> </ol> <p><b>Disadvantages:</b> 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.</p> <p><b>2.Mass Selection:</b></p>	

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 genotypically 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 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<sub>1</sub> 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)

#### 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 R<sub>0</sub>, R<sub>1</sub> and R<sub>2</sub> 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**



2023-24

**TEACHING NOTES**

**Paper 7A**

**SEED TECHNOLOGY**

<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Seed and grain: Definitions, importance of seed; structure of Dicot and Monocot seed.
<b>Hours Required</b>	04
<b>Learning Objectives</b>	To learn structure of Dicot and Monocot seed
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Peas, beans, maize
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	BLACK BOARD
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity Planned after teaching</b>	SEMINAR, SLIP TEST, QUIZ
<b>Activities outside the class</b>	Nil
<b>Any other activity</b>	NIL
<b>Synopsis</b>	

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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Role and goals of seed technology; characteristics of quality seed material.
<b>Hours Required</b>	03
<b>Learning Objectives</b>	To learn Role and goals of seed technology and characteristics of quality seed material
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Peas, beans, maize, food, oil, vegetables
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	BLACK BOARD
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity Planned after teaching</b>	SEMINAR, SLIP TEST, QUIZ
<b>Activities outside the class</b>	nil
<b>Any other activity</b>	NIL
<b>Synopsis</b>	<p><b>Role of seed technology:</b></p> <ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> <li>4. Improved seed – a medium for rapid rehabilitation 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 rehabilitate the agricultural production of foods grains in the country</li> </ol> <p><b>Goals of Seed Technology:</b></p> <p>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:</p> <ol style="list-style-type: none"> <li>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</li> <li>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.</li> <li>3. Assured high quality of seeds: This is necessary to obtain the expected dividends from the use of seeds of improved varieties.</li> </ol>

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Dormancy, causes and methods to break seed dormancy.
<b>Hours Required</b>	03
<b>Learning Objectives</b>	Skills on various methods to break the seed dormancy.
<b>Previous Knowledge to be reminded</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	BLACK BOARD, LAPTOP
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
<b>Activities planned outside the class</b>	TO VISIT CROP FIELDS TO OBSERVE DISEASE SYMPTOMS OF VIRUS
<b>Any other activity</b>	NIL
<b>Synopsis</b>	

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. Soaking treatment: in diluted solution of H<sub>2</sub>SO<sub>4</sub> , 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

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.

**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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	<b>Seed processing and storage</b> : Principles of seed processing
<b>Hours Required</b>	03
<b>Learning Objectives</b>	Determine seed moisture, seed germination percentage, seed viability and vigour.
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black Board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity Planned after teaching</b>	Student seminar , Gram staining
<b>Activities outside the class</b>	Field visit
<b>Any other activity</b>	Nil
<b>Synopsis</b>	

### 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
6. Determine seed storage needs in view of period or length of storage time and prevailing 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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Seed storage; orthodox and recalcitrant seeds, natural longevity of seeds.
<b>Hours Required</b>	03
<b>Learning Objectives</b>	Determine seed moisture, seed germination percentage, seed viability and vigour
<b>Previous Knowledge to be reminded</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity Planned after teaching</b>	Student seminar
<b>Activities planned outside the class</b>	Nil
<b>Any other activity</b>	Nil
<b>Synopsis</b>	<p>Depending on the longevity of seeds during storage, seeds can be divided into two categories;</p> <p><b>1. Orthodox Seeds:</b> Orthodox seeds are long-lived seeds. They can be successfully 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%.</p> <p><b>2. Recalcitrant Seeds:</b> They are short-lived seeds, which cannot be dried to moisture contents below 30% without injury and are unable to tolerate freezing.</p> <p>They are difficult to store successfully because of their high moisture content encourages microbial contamination and results in more rapid seed deterioration.</p> <p>Storage of these seeds at subzero temperatures causes the formation of ice crystals, which disrupts cell membranes and causes freezing injury.</p> <p>These seeds are from perennial trees in the moist tropics such as coconut, coffee, cacao, citrus etc. These seeds mature and exist in their fruits and are covered with fleshy or juicy ariloid layers and impermeable testa.</p> <p>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.</p> <p>In general recalcitrant seeds never go into dormancy but instead continue their development and progress towards germination.</p> <p>Most attempts at storing these seeds have focussed on using endogenous seed inhibitors such as abscisic acid .</p>

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Factors affecting longevity in storage; storage conditions, methods and containers
<b>Hours Required</b>	
<b>Learning Objectives</b>	Identify the seed borne pathogens and prescribe methods to prevent or control them. Evaluate various methods to produce healthy seeds
<b>Previous Knowledge to be reminded</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity after teaching</b>	Student interaction.
<b>Activities outside the class</b>	Student instructed to visit a nearer godown
<b>Any other activity</b>	NIL
<b>Synopsis</b>	<p><b>Factors influencing the life span of seeds:</b></p> <ol style="list-style-type: none"> <li><b>1. Genetic factors :</b> Seeds of some species are genetically and chemically equipped for longer storability than other under comparable conditions. Most long-lived seeds belong to species possessing hard, impermeable seed coat.</li> <li><b>2. Initial seed Quality:</b> The physical condition and physiological state of seeds greatly influence their life span. Seeds that have been broken, cracked deteriorate more rapidly than undamaged seeds. Several kinds of environmental stresses during seed development and prior to physiological maturity can reduce the longevity of seeds. For example deficiency of minerals (N,K,Ca), water and temperature extremes. Immature small seeds within a seed lot do not store as well as mature and large seeds within a seed lot. Hard seediness also extends seed longevity.</li> <li><b>3. Seed Moisture:</b> Moisture content of the seed is one of the important factors influencing the viability of seed during storage. Over the moisture range, the rate of deterioration increases with increase in moisture. At very low moisture content of 4 per cent seeds may be damaged due to extreme desiccation, or breakdown of membrane structure hastens deterioration</li> <li><b>4. Relative humidity and Temperature:</b> 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 %.</li> <li><b>5. Provenance:</b> 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.</li> <li><b>6. Pre and post harvest conditions:</b> 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.</li> </ol>

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Definition of seed vigour, viability and longevity
<b>Hours Required</b>	2
<b>Learning Objectives</b>	Understand concepts of seed vigour, viability and longevity
<b>Previous Knowledge to be reminded</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	BLACK BOARD, CHARTS AND LAPTOP
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity P after teaching</b>	QUIZ, SEMINARS, SLIP TESTS
<b>Activities outside the class</b>	FIELD VISIT TO OBSERVE BACTERIAL DISEASE IN CROPS.
<b>Any other activity</b>	NIL
<b>Synopsis</b>	
<p><b>Seed vigor</b> Seed vigor 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 vigor 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 storage. These 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 vigor 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 vigor and therefore the ability to perform. These seed vigor differences exist in seed lots of agricultural, horticultural and silvicultural species (ISTA, 2009).</p> <p><b>Seed viability</b> 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 seeds. In this lab we will apply two methods of predicting seed viability.</p>	

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Seed sampling and equipment.
<b>Hours Required</b>	02
<b>Learning Objectives</b>	To learn Seed sampling and equipment
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Handful samples
<b>Additional Inputs</b>	nil
<b>Teaching Aids Used</b>	BLACK BOARD, LAPTOP, CHART
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity P after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
<b>Activities outside the class</b>	Industrial visit
<b>Any other activity</b>	NIL
<b>Synopsis</b>	
<p><b>Seed sampling Objectives:</b>  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.</p> <p><b>Seed Lot :</b> 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.</p> <p><b>Criteria for Seed Lot:</b></p> <ol style="list-style-type: none"> <li>1. It must be homogenous.</li> <li>2. Of same variety, same season, same producer.</li> <li>3. Moisture must be homogenous.</li> <li>4. Must be found in same place.</li> <li>5. Must be kept in similar containers.</li> <li>6. Must be accessible for sampling.</li> <li>7.</li> </ol> <p><b>Sampling instruction:</b> Person taking sample has to get permission from the owner of the lot in writing Take three representative samples.</p> <p>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.</p> <p><b>Types of sample</b></p> <p>(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.</p> <p>(ii) (ii) Composite sample The primary samples are thoroughly mixed and combined to form composite sample.</p> <p>(iii) (iii) Submitted sample Sample submitted to the Seed Testing Lab – Obtained from composite sample.</p> <p>(iv) (iv) Working sample Obtained from submitted sample after through mixing and dividing - used to conduct tests like germination and purity.</p>	

**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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Physical purity analysis.
<b>Hours Required</b>	02
<b>Learning Objectives</b>	To learn Physical purity analysis.
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Husk, dust, stones, debris
<b>Additional Inputs</b>	Seeds with contaminations.
<b>Teaching Aids Used</b>	Charts, Black board, laptop, projector.
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity P after teaching</b>	Interaction, Quiz, Student seminars & Slip test.
<b>Activities outside the class</b>	Nil
<b>Any other activity</b>	Nil
<b>Synopsis</b>	

### 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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Seed moisture, methods of moisture determination.
<b>Hours Required</b>	03
<b>Learning Objectives</b>	To learn Seed moisture – importance
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity after teaching</b>	Go to rice fields to observe blast disease of rice.
<b>Activities outside the class</b>	Students asked to recognize citrus canker.
<b>Any other activity</b>	nil
<b>Synopsis</b>	<p>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  <b>Importance:</b> 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.</p> <p>Methods of moisture determination in seed Moisture meter method:</p> <p><b>Estimation as quick and convenient</b></p> <ul style="list-style-type: none"> <li>• Estimation is approximate (not precise)</li> <li>• Estimation is generally based on electric conductivity</li> <li>• Meter(s) to be calibrated, for each species</li> <li>• Only to be used if, the results are comparable with an oven method</li> </ul> <p><b>Air oven method:</b></p> <ul style="list-style-type: none"> <li>• Standard reference method</li> <li>• Estimation is precise</li> <li>• Seed moisture is removed by drying (under specified temperature for specific duration)</li> <li>• Approved by ISTA</li> </ul> <p><b>Weight of submitted sample</b></p> <ul style="list-style-type: none"> <li>• 100 g for species that have to be ground</li> <li>• 50 g for all other species</li> <li>• Be submitted in polythene bags.</li> </ul> <p><b>Equipments Moisture meter(s) of different types</b>• 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 <math>\leq 8</math> mm: 4-5 g is <math>\geq 8</math> mm: 10 g Sample be thoroughly mixed• Stir the sample with spoon or pour the sample back and forth between two similar containers</p>



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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Seed germination standard germination test; TZ test to determine seed viability; seed health testing.
<b>Hours Required</b>	02
<b>Learning Objectives</b>	To learn skills related to various seed testing methods
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity after teaching</b>	Interaction, quiz , student seminars
<b>Activities outside the class</b>	Field trip
<b>Any other activity</b>	Slip test
<b>Synopsis</b>	

### TZ TEST

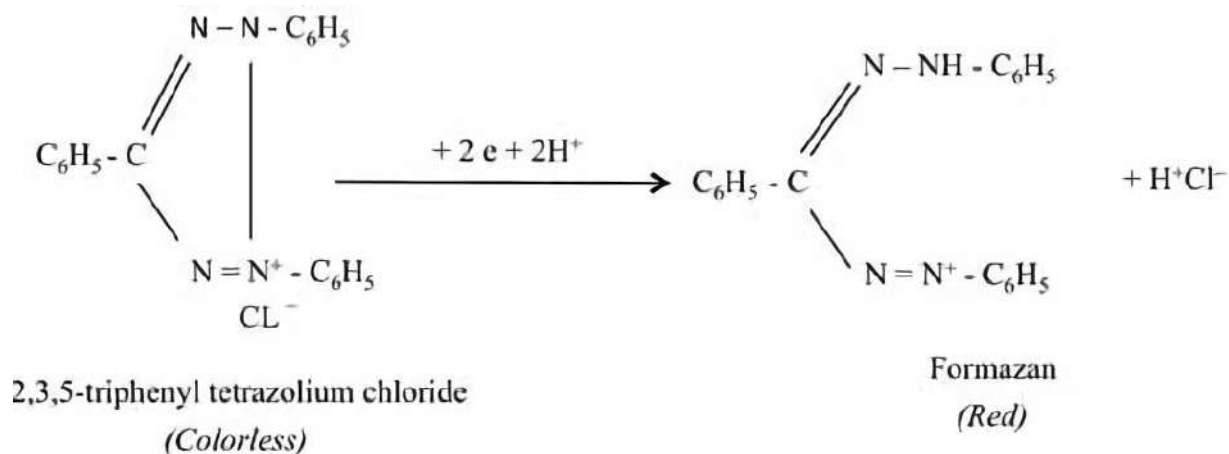
**Tetrazolium (TZ) testing** is a rapid method (can be finished within less than two days) for the evaluation of seed viability.

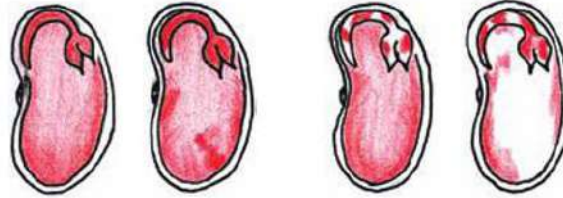
This method has been widely used by seed scientists to assess germination potentials, to determine the extent of seed damage, and to evaluate seed vigor and/or other seed lot problems.

The principle of TZ testing is based on the presence of dehydrogenase activity in viable seed tissues during the respiration process.

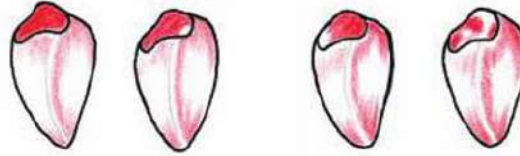
Dehydrogenase can catalyze the colorless 2,3,5 triphenyl tetrazolium chloride solution into a red dye formazan.

Therefore, living tissues of seeds that imbibe tetrazolium chloride will be stained red, while dead tissues will retain their natural color.





*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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	<b>Seed borne diseases:</b> A brief account of different seed borne diseases and their transmission.
<b>Hours Required</b>	03
<b>Learning Objectives</b>	Identify seed borne pathogens and methods to control them.
<b>Previous Knowledge to be reminded</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity after teaching</b>	Interaction, quiz , student seminars
<b>Activities outside the class</b>	Field trip
<b>Any other activity</b>	Slip test
<b>Synopsis</b>	<p>There are six main types of organisms associated with seeds in storage. They are bacteria, fungi, mites, insects, rodents and birds.</p> <p><b>Bacteria :</b> 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.</p> <p><b>Fungi:</b> 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.</p> <p><b>Insects and Mites:</b> Deterioration of seeds by insects and mites is a serious problem, particularly in warm and humid climates. Weevils, flour beetles or borers are rarely active below 8% moisture content and 18-20 oC, but are increasingly destructive as the moisture content rises to 15% and the temperature to 30 – 35oC.</p> <p>Mites do not thrive below 60% RH, although they have temperature tolerance that extends 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 20oC and the R.H. of less than 60%.</p> <p><b>Rodents and Birds:</b> Birds are constant source of seed loss in even small openings exists. All openings should be sealed or screened, if needed for ventilation.</p>

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 major bean diseases are seed-borne.

As a farmer plants infested seed, he also sows the potential for future disease problems. Seed transmission of plant pathogens is of concern in Latin America because most farmers plant seed saved from previous harvests.

The effect of seed-borne organisms upon seed germination is not well documented, but internally-borne fungi are associated with decreased seed germination and field emergence of dry beans found a correlation of -0.88 between percentage recovery of internally-borne fungi and seedling emergence.

Seed viability, germination and contamination by microorganisms also can be affected by mechanical damage which may occur during harvesting, threshing and /or planting.

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Different seed health testing methods for detecting microorganisms.
<b>Hours Required</b>	03
<b>Learning Objectives</b>	Identify seed born pathogens and methods to control them.
<b>Previous Knowledge to be reminded</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity after teaching</b>	Interaction, quiz , student seminars
<b>Activities outside the class</b>	Field trip
<b>Any other activity</b>	Slip test
<b>Synopsis</b>	

### **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.

Signature of the Lecturer

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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Management of seed borne diseases; seed treatment methods: spraying and dusting.
<b>Hours Required</b>	02
<b>Learning Objectives</b>	Identify seed born pathogens and methods to control.
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity after teaching</b>	Interaction, quiz , student seminars
<b>Activities p outside the class</b>	Field trip
<b>Any other activity</b>	Slip test
<b>Synopsis</b>	
<p><b>Control of Seed-Borne Bacteria</b>  It is reported that 95 species and varieties of bacteria may be seed-borne in numerous crops. Various bacterial pathogens are reported to be internally seed-borne in <i>Phaseolus vulgaris</i>, <i>Xanthomonas . phaseoli</i> and <i>Corynebacterium flaccumfaciens</i> can remain viable for two to ten and five to 24 years, respectively, in seeds. No satisfactory method of seed treatment will completely control internally-borne 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.</p> <p><b>Control of Seed-Borne Viruses</b>  Viruses are reported to be seed-borne in <i>Phaseolus vulgaris</i>. Bean common mosaic virus is transmitted internally in cotyledons and embryos but not in seed coats, while southern bean mosaic virus is transmitted in embryos and seed coats. Once seeds are infected, no seed treatment 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.</p> <p><b>Production of Pathogen-Free Seed</b>  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.</p>	

Signature of the Lecturer

Signature of the Principal

<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Indian seed Act; seed rules and seed order; new seed policy (1988).
<b>Hours Required</b>	02
<b>Learning Objectives</b>	To gain knowledge of seed policy (1988).
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity after teaching</b>	Interaction, quiz , student seminars
<b>Activities outside the class</b>	Field trip
<b>Any other activity</b>	Slip test
<b>Synopsis</b>	<p>The Government of India evolved a New seed policy implemented from October 1, 1988.</p> <p>The policy laid special emphasis on</p> <ol style="list-style-type: none"> <li>1. Import of high quality of seeds</li> <li>2. A time bound programme to modernize plant quarantine facilities</li> <li>3. Effective implementation of procedures for quarantine /post entry quarantine</li> <li>4. Incentives to encourage the domestic industry</li> <li>5. Import of quality seeds.</li> <li>6. Bulk import of seeds of coarse cereals, pulses and oil seeds may replace (or) displace the local productions.</li> </ol> <p>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>i.e.</i>,) incorporate the advantages of exotic variety to the local types(or) even direct multiplication's after adaptive trials.</p> <p>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.</p> <p>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.</p>

### Strengthening of quarantine

Since, 1st October 1988 only bulk imports of seeds were undertaken 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 outbreak of disease.

### Incentives to domestic seed industry

Indigenous seed production / seed industry will be affected because of the entry of multinational 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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Seed Inspector: Duties and responsibilities;
<b>Hours Required</b>	01
<b>Learning Objectives</b>	To learn the Duties and responsibilities
<b>Previous Knowledge to be reminded</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity after teaching</b>	Interaction
<b>Activities outside the class</b>	FIELD VISIT
<b>Any other activity</b>	NIL
<b>Synopsis</b>	

**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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	classes of seeds, phases of certification standards
<b>Hours Required</b>	02
<b>Learning Objectives</b>	Learn classes of seeds, phases of certification standards
<b>Previous Knowledge to be reminded</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity Planned after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR
<b>Activities planned outside the class</b>	NIL
<b>Any other activity</b>	NIL
<b>Synopsis</b>	
<p><b>Classes of seeds</b></p> <p>1. <b>Breeder's seed:</b> Is a seed or vegetative propagating material which is directly controlled by sponsoring breeder of institution &amp; which provides increases of foundation seeds.</p> <p>2. <b>Foundation seed:</b> 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.</p> <p>3. <b>Registered seed:</b> 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.</p> <p>4. <b>Certified seed:</b> 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.</p> <p><b>Seed Certification Procedure</b>  Good quality seeds refer to seeds having optimum genetic and physical purity , high germination procedure percentage and seed with optimum moisture content.</p> <p>It also includes seeds free from noxious weed seed and other crop seeds and free from seed borne diseases.</p> <p>To meet these criteria there is a need of certification.</p>	

**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, labels, 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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<b>Name of the Department/Subject</b>	BOTANY
<b>Name of the Lecturer</b>	P. SUDHAKAR
<b>Course/Group</b>	BZC
<b>Paper</b>	<b>Seed Technology</b>
<b>Name of the Topic</b>	Issue of certificates, tags and sealing
<b>Hours Required</b>	02
<b>Learning Objectives</b>	To learn Issue of certificates, tags and sealing
<b>Previous Knowledge to remind</b>	Post fertilization changes in angiosperms
<b>Examples/Illustrations</b>	Seed coat, testa and tegmen
<b>Additional Inputs</b>	Seeds of different plants
<b>Teaching Aids Used</b>	Black board, Laptop
<b>References Cited</b>	DuPont, Tianna. "Seed and Seedling Biology."
<b>Student Activity Planned after teaching</b>	TO WRITE SLIP TEST AND TO GIVE A SEMINAR, QUIZ.
<b>Activities planned outside the class</b>	Field visit
<b>Any other activity</b>	NIL
<b>Synopsis</b>	

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 field 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 verify 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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CURRICULAR PLAN

2023-24

DEPARTMENT OF  
POLITICAL SCIENCE

**Annual Curricular Plan: 2023-2024(Semester -I)**

Name of the College: PRR & VS GOVERNMENT COLLEGE

Name of the Department: Political Science

Name of the Lecturer: P.Priyanka

Class: B.A (Sem I)

COURSE-I: Fundamentals of Social Sciences

Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate	Remarks
sep - 2023	1	3	Unit – III – Society and Social Behaviour	Reference books	Class Room teaching	3			Class room discussion	1	Yes		
	2	3	1. Definition , Nature and Scope of Psychology	Reference books News paper articles Mobile phone	Class Room teaching	3			Class room Quiz & Group discussion	1	Yes		
	3	3	1 Definition , Nature and Scope of Psychology	Reference books	Class Room teaching	3			Class room Group discussion	1	Yes		
	4	3	1. Definition , Nature and Scope of Psychology	Reference books News paper articles Mobile phone	Class Room teaching	3			Class room & Group discussion	1	Yes		

Name of the College: PRR & VS GOVERNMENT COLLEGE      Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka      Class: B.A (Sem I)      COURSE-I: Fundamentals of Social Sciences

Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks	
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate date		
oct-2023	1	4+3	2. Importance of Social Interaction	Reference books	Class Room teaching -	3				Class room S Group discussion	1	Yes		
	2	4+3	2. Importance of Social Interaction	Reference books News paper articles	Class Room teaching -	3				Class room Group discussion	1	Yes		
	3	4+3	2. Importance of Social Interaction	Reference books News paper articles	Class Room teaching -	3				Class room Group discussion	1	Yes		
	4	4+3	2. Importance of Social Interaction	Reference books News paper articles	Class Room teaching -	3				Class room Group discussion	1	Yes		

Name of the College: PRR &amp; VS GOVERNMENT COLLEGE

Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka Class: B.A (Sem I)

COURSE-I: Fundamentals of Social Sciences

Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity			Co-curricular Activity			Remarks	
				Activity Conducted	Hours allotted	Whether Conducted	If not,	Activity Conducted	Hours allotted		Whether conducted
1	4+3	3. Need of Psychology for present Society	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Quiz & Group discussion	1	Yes	
2	4+3	3.Nee of Psychology for present Society	Collection of Information from various sources		6			Assignments	1		
3	4+3	3.Need of Psychology for present Society	Reference books News paper articles	Class Room teaching -	6			I – Internal Exam	1	Yes	
4	4+3	3.Nee of Psychology for present Society	Reference books	Class Room teaching -	6			Student Seminars	1	Yes	

Name of the College: PRR &amp; VS GOVERNMENT COLLEGE

Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka Class: B.A (Sem I)

COURSE-I: Fundamentals of Social Sciences

1	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate date	
Dec 2023	1	4+3	4. Thought process and Social Behavior4.	Reference books News paper articles Photographs	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
	2	4+3	Unit – 3 – Indian Constitution	Reference books News paper articles Photographs	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
	3	4+3	1. Philosophical Foundations of Indian Constitution	Reference books News paper articles Photographs	Class Room teaching Practical	6			Class room Quiz & Group discussion	1	Yes		
	4	4+3	2. Elements of Indian Constitution	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Quiz & Group discussion	1			

Name of the College: PRR & VS GOVERNMENT COLLEGE				Name of the Department: POLITICAL SCIENCE									
Name of the Lecturer: P.Priyanka Class: B.A (Sem I)				COURSE-I: Fundamentals of Social Sciences									
Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate	
Jan 2024	1	4+3	3. Study of Rights in Indian Constitution	Reference books News paper articles	Class Room teaching	6			Quiz	1	Yes		
	2	4+3	3. Study of Rights in Indian Constitution	Reference books	Class room teaching	6			----	1	Yes		
	3	4+3	Pongal Holidays		-				----	1	Yes		
	4	4+3	.4. Directive principles to State	Reference books News paper articles Photographs	Class Room teaching	6			Student Seminars, discussion	1	Yes		

  
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Signature of the Department I/C

  
Signature of the Principal

**Annual Curricular Plan: 2023-2024(Semester – III)**

of the College: PRR & VS GOVERNMENT COLLEGE				Name of the Department: Political Science								
of the Lecturer: P.Priyanka				Class: B.A (SEM-III)								
				Course :III: INDIAN GOVERNMENT AND POLITICS								
Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks
				Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate date	
1	4+3	UNIT I: Social And Ideological Base Of The Indian Constitution,	Reference books News paper articles Photographs	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
2	4+3	1. Constitutional Development in India during British Rule	Reference books News paper articles Photographs	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
3	4+3	A Historical Perspective with reference to Government of India Acts, 1909,1919 and 1935.	Reference books News paper articles Photographs	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
4	4+3	2. Constituent Assembly-Nature	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Quiz & Group discussion	1	Yes		
5	4+3	Composition, Socio - Economic, Philosophical Dimensions Features of the Indian Constitution.	Reference books News paper articles	Class Room teaching -	6			Quiz	1	Yes		

Name of the College: PRR & VS GOVERNMENT COLLEGE      Name of the Department: POLITICAL SCIENCE														
Name of the Lecturer: P.Priyanka    Class: B.A (SEM-III)    Course : III: INDIAN GOVERNMENT AND POLITICS														
Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks	
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate date		
Oct-2023	1	4+3	UNIT II: . Fundamental Rights Directive Principles of State Policy	Reference books News paper articles Photographs	Class Room teaching -	6				Class room Quiz & Group discussion	1	Yes		
	2	4+3	Fundamental Duties- Differences between Fundamental Rights-	Reference books News paper articles Photographs	Class Room teaching -	6				Class room Quiz & Group discussion	1	Yes		
	3	4+3	Directive Principles of State Policy	Reference books News paper articles Photographs	Class Room teaching -	6				Class room Quiz & Group discussion	1	Yes		
	4	4+3	2.The 'Doctrine of Basic Structure of the Constitution' with reference to Judicial Interpretations and Socio-Political Realities	Reference books News paper articles Photographs	Class Room teaching -	6				Class room Quiz & Group discussion	1	Yes		

Name of the College: PRR &amp; VS GOVERNMENT COLLEGE

Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka Class: B.A (SEM-III) Course : III: INDIAN GOVERNMENT AND POLITICS

Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity			Co-curricular Activity			Remarks
				Activity Conducted	Hours allotted	Whether Conducted If not alternate date	Activity Conducted	Hours allotted	Whether conducted If not, alternate date	
1	4+3	UNIT III: UNION EXECUTIVE, 1. President of India- Mode of Election Powers and Functions	Reference books News paper articles Photographs	Class Room teaching -	6		Class room Quiz & Group discussion	1	Yes	
2	4+3	Election powers and functions.	Reference books	Class room teaching	6		Group discussion	1	yes	
3	4+3	2. Parliament-Composition, Powers and Functions, Legislative Committees	Reference books News paper articles Photographs	Class Room teaching -	6		1 – Internal Exam	1	Yes	
4	4+3	Prime Minister and Council of Ministers- Powers and Functions, Role in Coalition Politics	Reference books News paper articles Photographs	Class Room teaching -	6		Student Seminars	1	Yes	

Month  
Nov-  
2023

Name of the College: PRR & VS GOVERNMENT COLLEGE					Name of the Department: POLITICAL SCIENCE							
Name of the Lecturer: P.Priyanka Class: B.A (SEM-III) Course : III: INDIAN GOVERNMENT AND POLITICS												
Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity			Co-curricular Activity			Remarks	
					Activity Conducted	Hours allotted	Whether Conducted	If not,	Activity Conducted	Hours allotted		Whether conducted
Dec 2023	1	4+3	UNIT IV: STATE EXECUTIVE 1. Governor- Mode of Appointment, Powers and Functions	Reference books News paper articles Photographs	Class Room teaching Practical	6			Class room Quiz & Group discussion	1	Yes	
	2	4+3	2. Legislature- Composition, Powers and Functions, Chief Minister									
	3	4+3	Council of Ministers- Powers and Functions	Reference books News paper articles Photographs	Class Room teaching Practical	6			Class room Quiz & Group discussion	1	Yes	
	4	4+3	Unit V: THE INDIAN JUDICIARY 1. Supreme Court- Composition and Appointments, Powers and Functions or Jurisdiction of the Supreme Court	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Quiz & Group discussion	1	Yes	

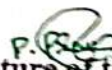
Name of the College: PRR & VS GOVERNMENT COLLEGE


Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka Class: B.A (SEM-III) Course : III: INDIAN GOVERNMENT AND POLITICS

Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided	Curricular Activity			Co-curricular Activity			Remark	
					Activity Conducted	Hour	Whether	Activity Conducted	Hour	Whether		
Jan 2024	1	4+3	Judicial Review, Judicial Activism. 2.High Court-Composition, Powers and Functions	Reference books News paper articles Photographs	Class Room teaching	6			Quiz	1	Yes	
	2	4+3	Sankranti Holidays		-					1		
	3	4+3	Debates on the mode of appointment of Judges- National Judicial Appointments Commission and Judicial Reforms.	Reference books News paper articles Photographs	Class Room teaching	6			II - Internal Exam	1	Yes	
	4	4+3	Commission and Judicial Reforms. revision	Reference books News paper articles Photographs	Class Room teaching	6			Student Seminars	1	Yes	

  
Signature of the Lecturer

 Signature of the Department I/C

  
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Sri Potti Srinamulu Nellore Dt.

**Annual Curricular Plan: 2023-2024 (Semester -IV)**

Name of the College: PRR & VS GOVERNMENT COLLEGE

Name of the Department: Political Science

Name of the Lecturer: P.Priyanka Class: BA (Sem IV)

**COURSE-V: WESTERN POLITICAL THOUGHT**

Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate	
May	1	4+3	UNIT 1 ANCIENT GREEK POLITICAL THOUGHT 1.Features of Indian Federal System	Reference books	Class Room teaching	6			Class room discussion	1	Yes		
	2	4+3	Theory of Justice-Ideal State and Education	Reference books News paper articles Mobile phone	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
	3	4+3	2. Aristotle-Theory of State	Reference books	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
	4	4+3	Classification of Governments	Reference books News paper articles Mobile phone	Class Room teaching	6			Class room & Group discussion	1	Yes		
	5	4+3	Citizenship, Slavery and Theory of Revolutions.	Reference books news paper articles	Class Room teaching	6			Quiz	1	Yes		

Name of the College: PRR & VS GOVERNMENT COLLEGE      Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka    Class: B.A (SEM-V)    Course VII(B): LOCAL ADMINISTRATION

Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate date	
oct-2023	1	4+3	Unit: II MEDIEVAL AND MODERN POLITICAL THOUGHT 1. St. Augustine-Theory of Two Cities.	Reference books	Class Room teaching -	6	Yes		Class room S Group discussion	1	Yes		
	2	4+3	1. St. Augustine-Theory of Two Cities.	Reference books News paper articles	Class Room teaching -	6	Yes		Class room Group discussion	1	Yes		
	3	4+3	2. Niccolo Machiavelli-State and Statecraft.	Reference books News paper articles	Class Room teaching -	6	Yes		Class room Group discussion	1	Yes		
	4	4+3	2. Niccolo Machiavelli-State and Statecraft.	Reference books News paper articles	Class Room teaching -	6	Yes		Class room Group discussion	1	Yes		

Name of the College: PRR &amp; VS GOVERNMENT COLLEGE

Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka Class: B.A (SEM-V)

Course : VII( B): LOCAL ADMINISTRATION

Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity			Co-curricular Activity			Remarks	
				Activity Conducted	Hours allotted	Whether Conducted If not,	Activity Conducted	Hours allotted	Whether conducted If not,		
Month Nov- 2023	4+3	Unit III CONTRACTUAL POLITICAL THOUGHT 1. Thomas Hobbes- Social Contract and Absolute Sovereignty.	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Quiz & Group discussion	1	Yes	
	4+3	-1. Thomas Hobbes- Social Contract and Absolute Sovereignty.	Collection of Information from various sources		6			Assignments	1		
	4+3	2. John Locke- Human Nature, State of Nature, Social Contract, Rights and Limited Government3	Reference books News paper articles	Class Room teaching -	6			1 – Internal Exam	1	Yes	
	4+3	. Jean Jacques Rousseau- Human Nature, State of Nature, Social Contract, General Will and Popular Sovereignty	Reference books	Class Room teaching -	6			Student Seminars	1	Yes	

Name of the College: PRR &amp; VS GOVERNMENT COLLEGE

Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka Class: B.A (SEM-V) Course : VII( B): LOCAL ADMINISTRATION

1	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity			Remarks	
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted		If not, alternate date
Dec 2023	1	4+3	UNIT:IV. UTILITARIAN POLITICAL THOUGHT 1. Jermy Bentham-Theory of Utility, Law and Reforms.	Reference books News paper articles Photographs	Class Room teaching	6			Class room Quiz & Group discussion	1	yes		
	2	4+3	1. Jermy Bentham-Theory of Utility, Law and Reforms.	Reference books News paper articles Photographs	Class Room teaching	6			Class room Quiz & Group discussion	1	yes		
	3	4+3	2. J.S.Mill-Theory of Liberty and Representative Government.	Reference books News paper articles Photographs	Class Room teaching Practical	6			Class room Quiz & Group discussion	1	yes		
	4	4+3	2. J.S.Mill-Theory of Liberty and Representative Government.	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Quiz & Group discussion	1	yes		

### Annual Curricular Plan: 2023-2024(Semester -IV)

Name of the College: PRR & VS GOVERNMENT COLLEGE

Name of the Department: Political Science

Name of the Lecturer: P.Priyanka Class: B.A (SemV)

#### COURSE-IV: INDIAN POLITICAL PROCESS

Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate	
sep - 2023	1	4+3	UNIT FEDERAL PROCESSES 1.Features of Indian Federal System	Reference books	Class Room teaching	6			Class room discussion	1	Yes		
	2	4+3	Centre-State Relations- Legislative, Administrative and Financial	Reference books News paper articles Mobile phone	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
	3	4+3	2.Emerging Trends in Centre-State Relations	Reference books	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
	4	4+3	Restructuring Centre-State Relations	Reference books News paper articles Mobile phone	Class Room teaching -	6			Class room & Group discussion	1	Yes		
	5	4+3	Recommendations M.M.Punchi Commission	Reference books news paper articles	Class Room teaching -	6			Quiz	1	Yes		

Name of the College: PRR & VS GOVERNMENT COLLEGE

Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka Class: B.A (SEM-V)

Course VII(B): LOCAL ADMINISTRATION

Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks	
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate date		
oct-2023	1	4+3	Unit: II <b>ELECTORAL PROCESSES</b> 1.The Election Commission of India	Reference books	Class Room teaching -	6				Class room S Group discussion	1	Yes		
	2	4+3	1.The Election Commission of India, Powers and Functions.	Reference books News paper articles	Class Room teaching -	6				Class room Group discussion	1	Yes		
	3	4+3	2.Issues of Electoral Reforms,	Reference books News paper articles	Class Room teaching -	6				Class room Group discussion	1	Yes		
	4	4+3	Voting Behaviour- Determinants and Problems of Defections	Reference books News paper articles	Class Room teaching -	6				Class room Group discussion	1	Yes		

Name of the College: PRR & VS GOVERNMENT COLLEGE

Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka Class: B.A (SEM-V) Course : VII (B): LOCAL ADMINISTRATION

Month  
Nov-  
2023


Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity			Co-curricular Activity			Remarks	
				Activity Conducted	Hours allotted	Whether Conducted	If not,	Activity Conducted	Hours allotted		Whether conducted
1	4+3	Unit III GROSSROOT DEMOCRACY- DECENTRALISATION 1. Panchayat Raj system - Local and Urban Governments	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Quiz & Group discussion	1	Yes	
2	4+3	-Structure, Powers and Functions.	Collection of Information from various sources		6			Assignments	1		
3	4+3	2. Democratic Decentralization- Rural Development and Poverty	Reference books News paper articles	Class Room teaching -	6			1 - Internal Exam	1	Yes	
4	4+3	All deviation with reference to 73 <sup>rd</sup> and 74 <sup>th</sup> Constitutional Amendment Acts, Challenges and Prospects.	Reference books	Class Room teaching -	6			Student Seminars	1	Yes	

of the College: PRR & VS GOVERNMENT COLLEGE Name of the Department: POLITICAL SCIENCE  
 of the Lecturer: P.Priyanka Class: B.A (SEM-V) Course : VII(B): LOCAL ADMINISTRATION

Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks
				Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate	
1	4+3	UNIT-V: REGULATORY AND GOVERNANCE INSTITUTIONS 1. NITIAyog: Finance Commission,	Reference books News paper articles	Class Room teaching	6			Quiz	1	Yes		
2	4+3	Comptroller and Auditor General of India.	Reference books	Class room teaching	6			---	1	Yes		
	4+3	Pongal Holidays		-				---	1	Yes		
	4+3	2. Central Vigilance Commission, Central Information Commission, Lokpal and Lokayukta.	Reference books News paper articles Photographs	Class Room teaching	6			Student Seminars, discussion	1	Yes		

  
 of the Lecturer

  
 Signature of the Department I/C

  
 Signature of the Principal  
 PRR. & VS Govt. Degree College  
 VIDAVALUR- 524 318.  
 Sri Potti Srinamulu Nellore Dt.

**Annual Curricular Plan: 2023-2024 (Semester - V)**

College: PRR & VS GOVERNMENT COLLEGE

Name of the Department: Political Science

Lecturer: P. Priyanka Class: B.A (Sem V)

Course: VIII(B) : E-GOVERNANCE

Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks
				Activity Conducted	Hours allotted	Whether Conducted	If not, alternate	Activity Conducted	Hours allotted	Whether conducted	If not, alternate	
1	4-3	UNIT I: Brief Introduction to Governance-E-Governance - Meaning, Definition, Nature, Scope, Objectives	Reference books	Class Room teaching	6			Class room discussion	1	Yes		
2	4-3	E-Governance- E-Governance and Good Governance-Global trends in the growth of E-Governance.	Reference books News paper articles Mobile phone	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
3	4-3	Unit II: E-Governance in India - National E-Governance Plan (NeGP)-National Informatics	Reference books News paper articles Mobile phone	Class Room teaching	6			Class room Quiz & Group discussion	1	Yes		
4	4-3	E-Governance-E-Governance Implementations: Required infrastructure of Network,	Reference books News paper articles Mobile phone	Class Room teaching	6			Class room & Group discussion	1	Yes		
5	4-3	Major E-Governance Projects and Initiatives: Aadhar	Reference books news paper articles	Class Room teaching	6			Quiz	1	Yes		

Name of the College: PRR & VS GOVERNMENT COLLEGE

Name of the Department: POLITICAL SCIENCE

Name of the Lecturer: P.Priyanka Class: B.A (SEM-V)

Course VII(B): E-GOVERNANCE

Month	Week	Hours available	Syllabus topic	Additional Input/ Value Addition Provided /taught	Curricular Activity				Co-curricular Activity				Remarks
					Activity Conducted	Hours allotted	Whether Conducted	If not, alternate date	Activity Conducted	Hours allotted	Whether conducted	If not, alternate date	
1	4+3	Unit: III Revenue raising Local Governments-Grants, Aid and support from Centre and State	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Group discussion	1	Yes			
2	4+3	Governments-Public Private Partnerships-Concept of Local Development-Village	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Group discussion	1	Yes			
3	4+3	SWOC analysis of a village, existing conditions, expected developmental opportunities	Reference books News paper articles Photographs	Class Room teaching -	6			Class room Group discussion	1	Yes			
4	4+3	SWOC analysis of a village, existing conditions, expected developmental opportunities	Reference books News paper articles	Class Room teaching -	6			Class room Group discussion	1	Yes			