Department Of Computer Science
Program Outcome
B.Sc. I – Computer Science 2022-23

- Historical development of Computer Science.
- Scope of Computer Science .
- Application And Uses of Computer Science.
- Introduction of operating system.
- Introduction of Application software such as Microsoft office .
- Concept of Green IT .
- Introduction of Programming languages such as machine ,Assembly, High level
      Language. Study of 'C' Programming Language
- Introduction Of Web Designing with HTML ,CSS and Java script .

Program Outcome [B.Sc. II – Computer Science] 2022-23

- Introduction of Data Structure such as Stack, Queue,linked list, Graph ,Searching
      ,Sorting Tree.
- Study of Software Engineering
- Introduction of Object Orientated programming language core Java Language
- Study of Database Management System

Program Outcome [B.Sc. III-Computer Science] 2022-23

- To Understand how to design ,implement ,test , debug C # Application
- To study the concept of Object oriented programming such as threading ,windows application
- To understand the concept of Core Java programming
- Operating System Concept such as Processes management ,Storage Management
- To create Python Application
- To Study and create Web application using ASP.Net ,Advance Java
- To Study the Data communication and Networking concept
- Introduction Of software testing concept

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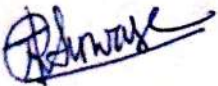
Department Of Computer Science

Laboratory Skills: Computer Science students would master the following laboratory skills 2022-23

- work with standard lab safety protocols and procedures.

- work effectively in a team environment.

- document and maintain a record of all lab activities.

- Document and report on experimental protocols, results and conclusions
- review procedures and put them into your own words.

- understand and use of Computer System .

- preparation of Algorithm and flowchart before doing Program

- use appropriate methods to do Programming

- Analysis the Programming concept

- use common lab equipment

- Understand the programming Problem in different language and solve them in own words

- prepare the small Project of any language such as C#,C,Web technology and Python

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COURSE OUTCOME

Name of Department: Computer Science 2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Computer Science
SEM I / II / III / IV / V / VI	Sem.- I

COURSE NUMBER (PAPER NUMBER) -Paper -1

TITLE OF COURSE (NAME OF PAPER) Fundamental of Computer

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit-I **Unit I:-Introduction to Computer** Introduction to computers, Evolution of personal computers; Generation of computers; Elements of a computer processing system- Hardware & Software, various categories of software; Computer Organization Overview-CPU, I/O devices, storage devices and media; Various type of displays and other peripherals used in PCs.	Learn and practice basic concepts of computers, types of computer, software, hardware input devices like keyboard and mouse etc.	Successful students will able to learn computer peripherals, types, knowledge of software & hardware etc.
Unit-II **Operating System Concept** Introduction to Operating system, Purpose of Operating Systems, services and features of OS, Types of Operating System, Components of OS. Introduction to PC Operating Systems:- DOS, Windows operating System, Linux operating system, Concept and working with files and folders. Introduction to Mobile Operating System: -Android, Windows, IOS, Symbian **Introduction to Green IT:-**Environmental Impacts of IT, Holistic Approach to Greening IT, Green IT Standards and Eco- Labelling, Enterprise Green IT Strategy , Green IT: Burden or Opportunity?Hardware :Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose Software: Introduction, Energy-Saving Software Techniques, Evaluating and Measuring Software Impact to Platform Power.	learn basic concepts of computer and mobile Operating System Concept and Green IT concepts	Understanding the concept of Operating system, services and features of OS, Introduction to Mobile Operating System: -Android, Windows, IOS, Symbian

Unit III:-Microsoft Office Microsoft Word:-Introduction to MS Word, opening, creating, saving, deleting document, page setting, formatting page, formatting text, adding images, Header footers, border and shading, bullets, mail merge, Table, graphics, label, Templates, Wizards and Printing Techniques. Microsoft Excel:- Introduction to excel, File management in excel, operations related to workbook, Formatting sheet, adding formulate and functions, charts and maps, data	learn basic word processing skills with Microsoft Word, such as text input and formatting, editing, cut, copy and paste, spell check, margin and tab controls, keyboard shortcuts, printing, As well as how to include some graphics such as pictures and charts.	Successful students will be able to create PowerPoint presentation, Word documents, Excel knowledge.
menu, view menu, work with multiple worksheets, importing and exporting of data. Microsoft PowerPoint: Introduction and Applications of Power Point, Create a New Presentation, Adding Slides, Clip Arts, Smart art, Charts, Text ; images and other objects, Templates and Master Slides, Giving Animation effects, Links and Action buttons		

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COURSE OUTCOME

Name of Department: Computer Science   2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Computer Science
SEM I / II / III / IV / V / VI	Sem.- I

COURSE NUMBER (PAPER NUMBER) -Paper -II

TITLE OF COURSE (NAME OF PAPER) Programming Using C-I

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit I:-Introduction to Programming Programming languages (Machine Languages, Assembly Languages, High level languages), Compiler, Assembler, Interpreter .Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, documentation. ,Concept of Algorithm, Characteristics, Notation of Algorithm, Designing Algorithms Writing step by step procedure, Flowcharts- Definition, Symbol, features, representation in terms of Flow chart, Advantages and Limitations of Flow Charts, Pseudo code generation, Tracing, Testing,	Learn and practice basic concepts of Programming types of computer languages , and learn the algorithm ,flowchart etc.	Successful students will able to learn computer Languages ,types languages of etc.
Unit II:-Introduction to 'C' History, Features of C, Structure of 'C' programming, C-Tokens, Data types ,Operators, Control Statements- Conditional control statements, Looping, Unconditional control statements	learn basic concepts of computer Language 'C' ,Control Structure ,data types etc	Understanding the concept History, Features of C, Structure of 'C' programming, C-Tokens, Data types, Operators, Control Statements

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Unit III: -Arrays and String	Learn Array and string concept such	Successful students
Array definition and declaration, Types of array, Accessing Array, array manipulation, searching, insertion, deletion of an element from an array, basic matrix operations ,dynamic array, String-Declaration and Initialization of String, operation on string ,inbuilt String handling functions, arithmetic operation on string, table of string.	Learn Array and string concept such as Types of array, Accessing Array, array manipulation, searching, insertion, deletion of an element from an array, basic matrix operations ,dynamic array and String handling	Successful students will be able to create program of Array and String

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COURSE OUTCOME

Name of Department: Computer Science 2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Computer Science
SEM I / II / III / IV / V / VI	Sem.- II
COURSE NUMBER (PAPER NUMBER) Paper III	
TITLE OF COURSE (NAME OF PAPER) Introduction to Web Designing	

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit-I **Introduction to HTML & HTML5 and CSS:** Introduction to HTML, Overview of basic HTML , Structure of HTML, Creating and opening HTML file, Singular and paired tags, Text formatting tag, Anchor tag, Lists, Image, Image Map, Table, Frames and Frameset, HTML5: Introduction to HTML5, Need of HTML5, DOCTYPE Element, Tags-Section, Article, aside, header, footer, nav, dialog, figure etc. Events in HTML5, Input tag (Type, Auto focus, placeholder, required etc. attributes.) in HTML5, Graphics in HTML5, Media tags in HTML5	Learn and practice basic concepts of HTML & HTML5. Introduction to Internet, Requirement for Internet.	Successful students will able to design web pages using HTML & HTML5 languages, also students get the knowledge of Internet & Networking concepts.
Unit-II **Introduction to CSS** Introduction to CSS, Use of CSS, Types of CSS, Selectors, Properties, Values. CSS Properties :- Background, Text, Fonts, Link, List, Table, Box Model, Border, Margin, Padding, Display, Positioning, Floating, Opacity, Media type, Backgrounds and Borders Image, Values and Replaced Content, Text Effects,2D/3D Transformations ,Animations, Multiple Column Layout ,User Interface, CSS interact with JavaScript.	Learn basic concepts of CSS, types of CSS, how to add Border, Margin, Padding, Display etc in web pages.	Understanding the concept of CSS. How to apply CSS in web pages. I insert a graphic within a web page. Create a link within a web page. Create a table within a web page.

Unit –III **JavaScript** Introduction to JavaScript , JavaScript Variables & Data types, Operators, Bulit in functions in JavaScript ,Control structure in JavaScript ,DOM, Math, Array, History, Navigator, Location, Windows, String, Date, Document objects, user defined function, Validation in JavaScript, event & event handling in JavaScript.	Understand the basics of Javascript. Write the SCRIPT element for including Javascript in a web page. Be able to write out to a page using document. write. Declare and set values for Javascript variables	Successful students will be able to create Use operators, variables, arrays, control structures, functions and objects in JavaScript. Map HTML using the DOM - Document Object Model. Identify popular JavaScript Libraries. Create dynamic styles. Create animation on a web page.

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COURSE OUTCOME

Name of Department: Computer Science   2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Computer Science
SEM I / II / III / IV / V / VI	Sem.- II
COURSE NUMBER (PAPER NUMBER) Paper IV	
TITLE OF COURSE (NAME OF PAPER) Programming Using C-II	

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit I: -**Function and Pointer** Definition, declaration, function prototypes, Local and global variables, User defined functions, recursion, passing array and string to function, Storage classes Pointers-Definition and declaration, Operation on pointer ,Pointer initialization, Pointer and function, Pointer and array, Pointer of pointer, Call by value and Call By reference, Dynamic memory allocation.	Understand the basics of Function and pointer such as recursion using function .call by reference and call by value , Dynamic memory allocation	Successful studentswill able to design Program of function and pointer
Unit II: -**Structures and Union** Definition and declaration, copying and comparing of structure, Array of structures, Passing structure tofunction, Pointer to structure, Nested structure, self-referential structure, Size of and type def, Definition and declaration of union, difference between structure, union and array	Understand the concept of tructure and union such as declaration,compar ing of structure difference between structure ,unionand array	Successful students will be able to use structure and union in program
Unit III:-**File Handling** Defining, opening and closing of file, operations on file, Standard input and output functions, formatted input and output functions, File opening modes, Error handling, Random access of file, command line argument. Macros and PreprocessingFeatures of C preprocessor, Macro – Declaration ,Expansion, File Inclusion Graphics using C - VDU Basics, Simple library functions-get pixel, put pixel, line ,rectangle, circle, ellipse, arc etc.	Understand the basics of file handling such as input and output function ,file opening mode ,error handling ,macro definition ,use of graphics etc	Successful students will be able create program into file and graphics mode

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COURSE OUTCOME

Name of Department: Computer Science 2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Data Structure
SEM I / II / III / IV / V / VI	Sem.- III
COURSE NUMBER (PAPER NUMBER)	paper -V
TITLE OF COURSE (NAME OF PAPER)	Data Structure

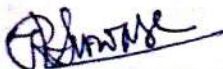| COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1 Introduction of Data Structure, Need of Data Structure, Types of Data Structure, ADT, Stack: Introduction to stack, Representation- static & dynamic, stack Operations, Application -infix to postfix & prefix, postfix evaluation, recursion, expression validity. Queues: Introduction to Queue, Representation -static & dynamic, Operations, Circular queue, Double ended queue, priority queues, Applications of Queue.	To impart the basic concepts of data structures and algorithms To understand the concepts about stacks, queues, lists, trees and graphs	1. Differentiate primitive and non-primitive structures
Unit 2 Linked List:-Introduction to List, Implementation of List – static & dynamic representation, Types of Linked List, Operations on List, Applications of Linked List – polynomial manipulation Trees: Concept & Terminologies, Binary tree, binary search tree, Representation – static &dynamic, Operations on BST – create, Insert, delete, traversals (preorder, inorder, postorder), counting leaf, non-leaf & total nodes, Height balance tree- AVL,B tree,B+ Tree, Graph- Graph terminology, Representation of graphs, Graph Traversal– BFS (breadth first search),DFS (depth first search), Minimum spanning Tree	To understand concepts about searching and sorting techniques To impart the basic concepts of data structures and algorithms	Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem

Unit 3 (15) Sorting: Bubble sort, Quick sort, Simple Insertion sort, Shell sort, Address calculation sort, Selection Sort, Heap Sort, Merge sort, Radix Sort. Searching: Linear Search, Binary Search, and Tree searching methods, Multiway search tree, Hash function (open and close)	To impart the basic concepts of data structures and algorithms	Apply sorting and searching algorithms to the small and large data sets.

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COURSE OUTCOME

Name of Department: Computer Science 2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Software Engineering
SEM I / II / III / IV / V / VI	SEM III
COURSE NUMBER (PAPER NUMBER)	Paper VI
TITLE OF COURSE (NAME OF PAPER) Software Engineering	

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1 System concepts: Introduction system, characteristics, Elements of system, Types of system, System Analysis, Role of System Analyst. Software Engineering: Definition, Characteristics of software, Qualities of software. System Development life cycle- Waterfall model, V-shape model, Spiral model, Prototyping, incremental, RAD, Agile.	To study fundamental concepts in software engineering, SDLC, software requirements specification, formal requirements specification and verification	At the end of the course, the student should be able to: Basic knowledge and understanding of the analysis and design of software systems
Unit 2 Software requirements: Types of Requirements: System, Functional, Non-functional, User. Fact finding techniques: Interviews, Questionnaire, Record reviews, Observation. Analysis and Design Tools: Flow chart, Decision tables and Trees, Structured English, HIPO. System Design: Data flow Diagram (Physical, Logical), Entity relation diagram ERD, Data Dictionary, structured chart, Input and output design, Case studies: Pay Roll, Fixed Deposit, Inventory system, College Admission System, Library System, Loan system etc.	To study the basic techniques for improving quality of software. Understand the fundamental principles of Software Engineering & will also have a good knowledge of responsibilities of project manager and how to handle these	Ability to apply software engineering principles and techniques to develop, maintain and evaluate large-scale software systems. To produce efficient, reliable, robust and cost-effective software solutions
Unit 3 Coding: Coding standards, Size Estimation, Effort Estimation, and Cost Estimation, Software Testing: Need of Testing, types of testing, Software Implementation and Maintenance: Traditional and incremental approaches, conversion methods, Overview of maintenance process, types of maintenance. Software Quality Assurance: SQA Tasks, Goals and Metrics, Software Reliability. Software risk management: definition, types of risk, risk identification-risk monitoring and management.	To understand the basic knowledge of different models	Ability to perform independent research and analysis. Ability to work as an effective member or leader of software engineering teams.

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COURSE OUTCOME

Name of Department: Computer Science 2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Web Design using Bootstrap and WordPress
SEM I / II/ III / IV / V / VI	Sem.- III
COURSE NUMBER (PAPER NUMBER)	SEC-1
TITLE OF COURSE (NAME OF PAPER)	Web Design using Bootstrap and WordPress

COURSE CONTENT	OBJECTIVES	OUTCOME
. Unit 1 Introduction about Bootstrap, Bootstrap History, Why Use Bootstrap, Downloading Bootstrap, Bootstrap CDN, Downloading the Bootstrap Files, Understanding the File Structure Layout- Bootstrap Grid System, Creating Fixed Layout, Fluid Layout, Responsive Web Design or Layout, Bootstrap Typography Bootstrap Forms- Form control, Select, Checks & radios, Range, Input group, Floating labels, Layout, Validation Bootstrap Tables, Lists, Images, Media Objects, Icons	To study development of responsive website using bootstrap Web Design or Layout, Bootstrap Typography Bootstrap Forms- Form control, Select, Checks & radios, Range, Input group, Floating labels, Layout, Validation Bootstrap Tables, Lists, Images, Media Objects, Icons	Student have understood of history of Bootstrap and Web Design or Layout, Bootstrap Typography Bootstrap Forms- Form control, Select, Checks & radios, Range, Input group, Floating labels, Layout, Validation etc.
Unit 2 Bootstrap Components-Accordion, Alerts, Badge, Breadcrumb, Buttons, Button group, Card, Carousel, Close button, Collapse, Dropdowns, List group, Modal, Nav bar , Navs & tabs, Offcanvas, Pagination, Placeholders, Popovers, Progress, Scrollspy, Spinners, Toasts, Tooltips Case study-Design e-commerce and your college website	To study the Bootstrap component such as Bootstrap Components-Accordion, Alerts, Badge, Breadcrumb, Buttons, Button group, Card, Carousel, Close button, Collapse, Dropdowns, List group, Modal, Navbar, Navs & tabs, Offcanvas, Pagination, Placeholders, Popovers, Progress, Scrollspy, Spinners, Toasts, Tooltips and case study	Student have understood and develop various types of bootstraps components and case study

Unit 3 Introduction CMS And WordPress, Why CMS, Advantages and Disadvantages of CMS, com vs. WordPress.org Creating a Word Press Site, Installing Word Press, Setting up Word Press in Local Server, Logging Into the Word Press Admin & General Site Settings Writing Posts & Formatting Text : Posts versus Pages, Creating a New Blog Post, Using the Visual Editor, Pasting Without Formatting & Clearing Formatting, Formatting Headings, Formatting Bulleted & Numbered Lists, Formatting Block quotes, Publishing a Post, Deleting a Post, Restoring a Post from the Trash (or Deleting it Delete Permanently) Creating Pages, formatting page, Publishing pages, Menu, Installing Themes, adding plugins, Working with Widgets	TO get knowledge of global Bootstrap CSS classes for images, typography, tables, grids, forms, buttons, and more . the reusable bootstrap components including icons, dropdowns, alerts navbars, breadcrumbs, popovers, and many more. Utilize the bootstrap javascript Plugins to develop modern web pages. Customize Bootstrap's elements with fewer variables and jQuery plugins to build our version. Build attractive website using Word Press or Boot Strap.	Understand global Bootstrap CSS classes for images, typography, tables, grids, forms, buttons, and more Understand the reusable bootstrap components including icons, dropdowns, alerts navbars, breadcrumbs, popovers, and many more. Utilize the bootstrap javascript Plugins to develop modern web pages. Customize Bootstrap's elements with fewer variables and jQuery plugins to build our version. Build attractive website using WordPress or BootStrap.

COURSE OUTCOME

Name of Department:COMPUTER SCIENCE 2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.		
NAME OF SUBJECT	Visual Programming Using C#		
SEM I / II / III / IV / V / VI	Sem V		
COURSE NUMBER (PAPER NUMBER)			
TITLE OF COURSE (NAME OF PAPER) Visual Programming Using C#			

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Introduction to NET and C# Block diagram of .net framework, The Common Language Runtime, Advantages of Managed Code, A Closer Look at Intermediate Language & Assemblies-Support for Object Orientation and Interfaces, Distinct Value and Reference Types, Strong Data Typing, Garbage Collection, Compiling and Running the Program, Variables, Data Types, Flow Control, Enumerations, Namespaces-The using Statement, Namespace Aliases, The Main() Method-Multiple Main() Methods, defining & using functions & its scope, Passing Arguments to Main(), Parameter passing technique.	To understand how to design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and control structures, string handling and functions.	Implement Object Oriented programming concept using basic syntaxes of control Structures, strings and function for developing skills of logic building activity using Java.
Unit 2: Object oriented programming in C# Classes and Structs, Class Members- Data Members, Function Members read-only Fields, properties and indexer, The Object Class-System, Object Methods, The ToString() Method and Functions, Constructors and its types, Destructor, Interfaces-Defining and Implementing Interfaces, Derived Interfaces, **Inheritance and Polymorphism:** Introduction- Types of Inheritance, Implementation Inheritance-methods, abstract classes and interfaces and packages. Polymorphism- Method overloading, Operator overloading	Discuss the principles of inheritance, interface and packages and demonstrate though problem analysis assignments how they relate to the design of faster application development can be achieved.	Demonstrates how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved.
Unit 3:- Exception, Threading, Delegate and IO Exception Handling:-Try, catch, and throw, finally, Nested try, Custom exception **Threading:-**Introduction- Applications with Multiple Threads, Thread Priorities, Synchronization, Life Cycle.**Delegate and Events:-** Delegeates, Types of delegates- single cast, multicast and anonymous delegates, **Event0 and Collection Classes:-** Stream Classes, Console I/O, File Stream and Byte-Oriented File I/O, Character based File I/O.	4. To understand importance of Multi-threading & different exception handling mechanisms	Demonstrate understanding and use of different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.

COURSE OUTCOME

Name of Department: Computer Science2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	DBMS Using Oracle
SEM I / II / III / IV / V / VI	Sem.: - IV

COURSE NUMBER (PAPER NUMBER): - **IX**

TITLE OF COURSE (NAME OF PAPER): - DBMS Using Oracle

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: (15) Introduction to database system:-Definition, Limitations of traditional file system, Advantages of DBMS, Components of DBMS, Database Architecture, Database Users, Schemas and instances, 2 tier and 3 tier architecture, Database languages, Types of data models- relational, Network, Hierarchical, Distributed E-R model: E-R Diagram, entities, attributes and its types, Relationship and relationship sets, Cardinality, Degree, Generalization, Specialization, Aggregation. Relational Model and Database design:-Relation, Domain, Tuples, types of keys, relational integrity rules, Dr. Codd's rules, Relational Algebra operations: - Select, Project, Cartesian Product, Union, Set difference, Natural Join, Outer Join, Dependencies and its types, Normalization and its types-1NF, 2NF, 3NF, BCNF, lossless joins.	To understand the fundamental concepts of database. 2. It helps in developing skills for the design and implementation of a database applications	Demonstrate the concepts of Relational database model, ER model and Distributed databases. 2. Design E-R Model for given requirements and convert the same into database tables
Unit 2: (10) Transaction Management & Concurrency Control: -Introduction, Definition, properties, transaction states, scheduling and its types, conflict and view serializability. Introduction to Concurrency Control, problems of concurrency control. lock based protocols, timestamp-based protocol, deadlock, deadlock handling. Database recovery and Atomicity: -Introduction, recovery algorithms, log base recovery, shadow paging, checkpoints or syncpoints or savepoints.	To understand creations, manipulation and querying of data in databases	Apply the concepts of Transaction processing, Concurrency control, Database Recovery and Back-up in applications.

Unit 3:	5. Undersetting SQL and PL/SQL	Use database techniques such as SQL & PL/SQL
SQL: DDL, DML, DCL, select: From, Where, Order by, Group by, Having, Intersect, Union, Distinct, Between, In, Between, Different types of functions, Delete, Update, Insert, Nested queries, joins, create, alter and drop, constrains, index, views, Triggers, Grant, Revoke, Commit, RollBack, Savepoint Introduction to PL/SQL, Advantages, Architecture, Datatypes, Variable and Constants, Using Built_in Functions, Conditional, Looping and Iterations Statements. Cursor in PL/SQL: Types of Cursors, Cursor Attributes, Cursor with Parameters, Cursors with LOOPs Nested Cursors, Cursors with Sub Queries and procedure. Procedures in PL/SQL: STORED PROCEDURES, PROCEDURE with Parameters (IN,OUT and IN OUT), Dropping a Procedure. Functions in PL/SQL: Difference between Procedures and Functions, types of functions and parameter modes Exceptions in PL/SQL		

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COURSE OUTCOME

Name of Department: COMPUTER SCIENCE 2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Visual Programming Using C#
SEM I / II / III / IV / V / VI	Sem V
COURSE NUMBER (PAPER NUMBER)	
TITLE OF COURSE (NAME OF PAPER)	Visual Programming Using C#

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Introduction to NET and C# Block diagram of .net framework, The Common Language Runtime, Advantages of Managed Code, A Closer Look at Intermediate Language & Assemblies-Support for Object Orientation and Interfaces, Distinct Value and Reference Types, Strong Data Typing, Garbage Collection, Compiling and Running the Program, Variables, Data Types, Flow Control, Enumerations, Namespaces-The using Statement, Namespace Aliases, The Main() Method-Multiple Main() Methods, defining & using functions & its scope, Passing Arguments to Main(), Parameter passing technique.	To understand how to design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and control structures, string handling and functions.	Implement Object Oriented programming concept using basic syntaxes of control Structures, strings and function for developing skills of logic building activity using Java.
Unit 2: Object oriented programming in C# Classes and Structs, Class Members- Data Members, Function Members read-only Fields, properties and indexer, The Object Class-System, Object Methods, The ToString() Method **Inheritance and Polymorphism:** Introduction-Types of Inheritance, Implementation Inheritance Abstract Classes and Functions, Sealed Classes and Functions, Constructors and its types, Destructor, Interfaces-Defining and Implementing Interfaces, Derived Interfaces, Polymorphism- Method overloading, Operator overloading	Discuss the principles of inheritance, interface and packages and demonstrate though problem analysis assignments how they relate to the design of methods, abstract classes and interfaces and packages.	Demonstrates how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved.
Unit 3:- Exception, Threading, Delegate and IO **Exception Handling:-**Try, catch, and throw, finally, Nested try, Custom exception **Threading:-**Introduction- Applications with Multiple Threads, Thread Priorities, Synchronization, Life Cycle.**Delegate and Events:-** Delegeates, Types of delegates- single cast, multicast and anonymous delegates, **EventIO and Collection Classes:-** Stream Classes, Console I/O, File Stream and Byte-Oriented File I/O, Character based File I/O	4. To understand importance of Multi-threading & different exception handling mechanisms	Demonstrate understanding and use of different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.

Controls: Common control Group, Data control Group, Dialog control Group, Container control Group, Menus and Context Menus: Menu Strip, Toolbar Strip, SDI and MDI Applications	design GUI base windows application using C#.	Able to develop windows applications using C#.

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COURSE OUTCOME

Name of Department: COMPUTER SCIENCE

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Core Java
SEM I / II / III / IV / V / VI	Sem V
COURSE NUMBER (PAPER NUMBER)	**Paper X**
TITLE OF COURSE (NAME OF PAPER)	Core Java

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Introduction to Java Programming Overview of Java, Features of Java as programming language /Platform, JDK Environment and tools **Java Programming Fundaments:-**Data types, Variables, Operators, Keywords, Naming Conventions, Structure of Java Program, Flow Control- Decision, Iterations, Arrays,	To understand how to design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and control structures, string handling andfunctions. To understand the Importance of Classes & objects along with constructors, Arrays and Vectors	Implement Object Oriented programming concept using basic syntaxes of control Structures, strings and function for developing skills of logic building activity using Java
Unit 2: Object oriented programming in Java Class – Members access control, Objects, Constructors, Use of 'this' keyword, Static, non-static data members and methods., public, private & protected data members **Inheritance & Polymorphism-**Access/Scope specifiers protected, Super, extends, single, multiple inheritance, Method overriding, Abstract classes & ADT, 'final' keyword, Extending interfaces	Discuss the principles of inheritance, interface and packages and demonstrate though problem analysis assignments how they relate to the design of methods, abstract classes and interfaces and packages.	Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem in Java. 3. Demonstrates how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved
Unit 3: Exception Handling, Threading and Collection framework Exceptions and Types, try..catch, finally block, throw & throws statement, user-defined exceptions, Java I/O package, byte & character stream, reader & writer, file reader & writer **Threading-**Java thread lifecycle, Thread class & run able interface Thread priorities & synchronization, Usage of	To understand importance of Multi-threading & different exception handling mechanisms	Demonstrate understanding and use of different exception handling mechanisms and concept of multithreading for robust faster and efficient application development

wait & notify **Collection framework :-** Collection overview, Collection interfaces, Collection classes Vector, Array list, Hash map, Hash table, Tree map, Tree set, Hash set, Properties, Stack		
Unit 4: Swing and event handling: Introduction to swing, difference between AWT and swing, hierarchy of Swing classes, Swing controls: - JButton, JTextfield, JLabel, JCheckBox, JRadionButton, JFame, Jtable, JList, JoptionPane, JMenuitem and JMenu ,etc	To understand how to develop GUI applications using Swing technology	Able to develop GUI applications using Swing technology

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COURSE OUTCOME

Name of Department: COMPUTER SCIENCE

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.	
NAME OF SUBJECT	Operating System	
SEM I / II / III / IV / V / VI	Sem - V	
COURSE NUMBER (PAPER NUMBER)	Paper XI	
TITLE OF COURSE (NAME OF PAPER)	Operating System	

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Introduction Operating System:- Definition Operating systems, Types of Operating Systems-Batch, Multiprogramming, Time-Sharing, Real-Time, Distributed, Parallel., OS Service, System components, System Calls, OS structure: Layered, Monolithic, Microkernel Operating Systems – Concept of Virtual Machine	To understand the main components of an OS & their functions	Describe the important computer system resources and the role of operating system in their management policies and algorithms.
Unit 2: Process Management: - Concept of Process, Process states, Process Control Block, Context switching, Operations on Process, Co-operating Process, Threads – Types of threads, Benefits of threads .Concept of Process Scheduling- Types of Schedulers, Scheduling criteria, Scheduling algorithms-Preemptive and Non-pre emptive , FCFS, SJF, Round Robin, Priority Scheduling, Multilevel Queue Scheduling, Multilevel- feedback Queue Scheduling	To study the process management and scheduling.	Understand the process management policies and scheduling of processes by CPU
Unit 3: Process Synchronization and Deadlocks: - The Producer Consumer Problem, Race Conditions, Critical Section Problem, Semaphores, Classical Problems of Synchronization: Reader-Writer Problem, Dinning Philosopher Problem, Critical Regions. Definition, System Model, Dead Lock Characterization, Resource Allocation Graph, Methods of Handling Dead Locks- Deadlock Prevention, Deadlock Avoidance -banker's algorithm, resource request algorithm, Deadlock detection and Recovery.	To understand the concepts and implementation Memory management policies and virtual memory.	Evaluate the requirement for process synchronization and coordination handled by operating system
Unit 4: Storage Management :Memory Management: - Basic Hardware Address Binding, Logical and Physical address Space, Dynamic Loading, Overlays, Swapping, **Memory allocation:** Contiguous Memory allocation – Fixed and variable partition –	To understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used	Describe and analyze the memory management and its allocation policies. 5. Identify use and evaluate the storage

Internal and External fragmentation and Compaction, Paging, Segmentation. Basics of Virtual Memory, 9 demand paging, Page fault, Page Replacement policies: Optimal (OPT), First in First Out (FIFO), Least Recently used (LRU), Thrashing. **Storage Management:-** File Management: File concept, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free space management (bit vector, linked list, grouping). **Disk Management:** disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks.	to implement the different parts of OS	management policies with respect to different storage management technologies

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COURSE OUTCOME

Name of Department: COMPUTER SCIENCE

2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Python
SEM I / II / III / IV / V / VI	Sem - V
COURSE NUMBER (PAPER NUMBER)	**Paper XII**
TITLE OF COURSE (NAME OF PAPER)	Python

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1:- Introduction to Python: Features/Characteristics of Python, Installation and Working with Python, Structure of a Python Program, Writing simple python program, Executing python program using command line window and IDLE graphics window, Python Virtual Machine, Identifiers and Keywords, Operators (Arithmetic operators, Relational operators, Logical or Boolean operators, Assignment Operators, Bit wise operators, Membership operators, Identity operators), Operator Precedence and Associativity **Python Data Types:** -Python Variables, Data types in python, Built-in Datatypes, Bool datatype Sequences in python, Sets, Literals in python, User Defined Datatypes, Constants in python, Type conversion, Input and Output Statements, Command line arguments **Control Statements:**-Conditional Statements: if, if-else, nested if –else, Looping: for, while, nested loops, Loop manipulation using pass, continue, break, assert and else suite	Basics of Python programming Decision Making and Functions in Python	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python Express different Decision Making statements and Functions
Unit 2:- Strings, Collection Lists, Tuples, Dictionaries, Functions and, Modules: Strings: Introduction to String, String manipulation., Collection List: Introduction to List, Manipulating list., Tuples: Introduction to Tuples, Manipulating Tuples., Dictionaries: Concept of Dictionary, Techniques to create, update & delete dictionary items. **Functions, Modules :-** Difference between a Function and a Method, Functions:- Defining a function, Calling a function, Advantages of functions, Types of functions, Function parameters:-Formal parameters, Actual	Decision Making and Functions in Python	Express different Decision Making statements and Functions

parameters, Anonymous functions, Global and Local variables, Modules:- Importing module, Creating & exploring modules, Math module, Random module, Time module		
Unit 3:- Object Oriented Programming Features, Concept of Class & Objects, Constructor, Types of Variables, Namespaces, Types of Methods, Inner Classes, Constructors in Inheritance, Overriding Super Class Constructors and Methods, Types of Inheritance, Abstract Classes and Interfaces, The Super() Method, Operator Overloading, Method Overloading, Method Overriding	Object Oriented Programming using Python	Interpret Object oriented programming in Python
Unit 4: Regular Expressions, Exception Handling and File Introduction to Regular Expression, Advantages & Operations, Sequence characters in Regular Expression, Powerful pattern matching and searching, Password, email, url validation using regular expression, Pattern finding programs using regular expression **Exception :-** Errors in a Program, Exceptions, Exception handling, Types of Exceptions, User defined Exceptions **Python File Operation:-** Types of File, Opening and Closing a File, Reading and writing to files, Manipulating directories	Regular expression for pattern matching	Understand Regular expression and implement for pattern matching

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COURSE OUTCO

Name of Department: **COMPUTER SCIENCE**

2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Linux
SEM I / II / III / IV / V / VI	Sem - V
COURSE NUMBER (PAPER NUMBER)Paper XIII	
TITLE OF COURSE (NAME OF PAPER)	Linux

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Introduction of Linux:- History of Linux, Architecture of Linux system & features, Kernel, Shell & its type, Difference between Windows and Linux. Linux Distributions, Working environments: KDE, GNOME, Xface4, Hardware requirement, Installation procedure of Linux, Create partitions, Configuration of X system Users & Groups Management:- Create Users, Create groups, Special groups,Assigning permissions to users and Groups, File and Directory permissions - chmod, chown,chgrp. **Linux File System:-**Hierarchy of File system, File System parts - Boot Block, Super Block, Inode Block, Data Block, File types, Devices and Drives in Linux, Mounting devices (CD/DVD, usb, hard drive partition), file system	To introduce Basic Linux general purpose Commands	Identify the basic Linux general purpose commands
Unit 2: Linux Command Linux commands File and directory Management Commands:-mkdir, mdir, cd and pwd, file,ls, cat, more, less, File and Directory Operations: find, cp, mv, rm, ln etc, Printing the files - lpr,lpq, lprm etc. **Filter Commands & Editor:-** Filters: head, tail , pr, cut, paste, sort, uniq, tr, grep, egrep, fgrep, sed.**Communication commands:-** mesg, talk, write, wall.**Text Editors -** vi, vim, Archive and File compression commands **Shell Programming:-** Shell Variables, Meta characters, Shell Scripts – Control and Loop structure, I/O and Redirection, Piping.	To learn different editor To learn shell script concepts	Apply and change the ownership and file permissions using advance Linux commands
Unit 3: Linux System Management Process Management: Shell process, Parent and children, Process status, System process,	To learn file management and permission advance commands	4. Implement shell scripts.

Multiple jobs in background and foreground, Changing process priority with nice. Listing processes, ps, kill, premature termination of process .**Disk management and System Administration:**-Disk Partitioning - RAID, LVM etc., disk related Management Tools - Fdisk, Parted etc. , Boot Loaders - GRUB, LILO, Custom Loaders		
Unit 4:-Linux System and Network Administration System administration – Role of system administrator, identifying administrative tasks & files, Configuration and log files, Chkconfig, Security Enhanced Linux, Installing and removing packages with rpm command **Understanding various Servers:**- DHCP, DNS, Squid, Apache, Telnet, FTP, Samba.	To learn awk, grap, perl scripts	Apply basic of administrative task.

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COURSE OUTCOME

Name of Department: COMPUTER SCIENCE

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B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Web Technology
SEM I / II / III / IV / V / VI	Sem VI
COURSE NUMBER (PAPER NUMBER)	Paper XIV
TITLE OF COURSE (NAME OF PAPER) Web Technology	

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Introduction to ASP.Net Introduction to Web Architecture Model, Introduction to Visual Studio for Web Application,historical development of ASP.Net **Application and Page Frameworks** Application Location Options, Built-In Web Server, IIS,FTP, Web Site Requiring FrontPage, Extensions, The ASP.NET Page Life Cycle, The ASP.NET Page Structure Options, Inline Coding, New Code-Behind Pages, ASP.NET 2.0 Page Directives, @Page, @Master, @Control, @Import, @Implements, @Register, @Assembly, @PreviousPageType, @MasterType, @OutputCache,@Reference. ASP.NET Page Events, Dealing with PostBacks, Cross-Page Posting, ASP.NETApplication Folders, \App_Code Folder, \App_Data Folder, \App_Themes Folder, \App_GlobalResources Folder, App_LocalResources, \App_WebReferences, \App_Browsers,Compilation, Global.asax	To understand basic of ASP.Net	Understand basic of ASP.Net and web application.
Unit 2: ASP.NET Server Controls and Validation Controls ASP.Net Server Controls, Understanding Validation, Client-Side versus Server-Side, Validation,ASP.NET Validation Server Controls, Validation Causes, The Required Field Validator Server Control, The CompareValidator Server Control, The RangeValidator Server Control, The RegularExpressionValidator Server Control, The CustomValidator Server Control, The ValidationSummary Server Control, Turning Off Client-Side Validation, Using Images and Sounds for Error Notifications, Working with Validation Groups Master Pages: Introduction of Master Pages-	To understand different server controls used in ASP.Net for web application	Use different ASP.Net web server control to develop web application

The Basics of Master Pages, Coding a Master Page, Coding a Content Page, Mixing Page Types and Languages, Specifying Which Master Page to Use, Working with the Page Title, Working with Controls and Properties from the Master Page, Specifying Default Content in the Master Page, Programmatically Assigning the Master Page, Nesting Master Pages, Master Page Events, Themes and Skins		
Unit 3: ASP.Net State Management, Navigation and Security Application State, Session State, Client & server storing, View state, Cache, Hidden Variable, Session object, Profiles, Overview of HTTP Handler & Modules**Site Navigation:-** Site Navigation technique, SiteMap file, SiteMapPath, TreeView andMenuView control, Using XML file **ASP.NET web security:-** Authentication & Authorization, Windows & forms, User.identity, User.IsInRoles, Using Data Adapter, Debugging & error Handling, ASP.Net tracing, Page Level, Application Level, Debugging, Start Debugging session, Client side debugging, Exception Handling, On page, HTTP status code,	To understand master page concept To learn how to maintain state and security in web application.	Use master page for interactive design Maintain state and security in web application
Unit 4: ADO.Net and AJAX **Data Access with ADO.NET:-** ADO.NET Overview, Using Database Connections, Executing Commands, Calling Stored Procedures, Fast Data Access: The Data Reader, Data Adapter **Introduction to AJAX:-** Introduction to AJAX and Need of AJAX, Server side and client side architecture ScriptManager, UpdatePanel, Timer control.	To understand database connectivity with web application.	Connect any database with web application.

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COURSE OUTCOME

Name of Department: COMPUTER SCIENCE

2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.		
NAME OF SUBJECT	Advanced Java		
SEM I / II / III / IV / V / VI	Sem VI		
COURSE NUMBER (PAPER NUMBER)	**Paper XV**		
TITLE OF COURSE (NAME OF PAPER) Advanced Java			
COURSE CONTENT	OBJECTIVES	OUTCOME	
Unit -1:-JDBC Introducing JDBC: Describing Components of JDBC, Features of JDBC, JDBC Architecture: Types of Divers:Advantages and disadvantages of Drives, Use of Drivers, JDBC Statement and Methods:-Statement, PreparedStatement, CallableStatement, execute(), executeQuery(), executeUpdate(), Working with Resultset interface,Working with Resultset and MetaData.	To understand database connectivity using JDBC	Use database connectivity using JDBC.	
Unit -2:-Servlet Introducing CGI, Introducing Servlet, Advantages of Servlet over CGI, Features of Servlet,Introducing Servlet API, Javax.servlet package, Javax.servlet.http package, Introducing Servlet,Advantages of Servlet over CGI, Features of Servlet, Servlet life Cycle, Init(), Service(), Destroy(),Working with GenericServlet and HttpServlet, RequestDispatcher interface, Include() andforward(), Use of equestDispatcher, Session in Servlet, Introducing session, Session trackingmechanism, Cookies, Advantages & disadvantages, use of cookies, Hidden form filed, Advantages & disadvantages, use of Hidden form filed, URL rewritten, disadvantages, use of URL rewritten, HttpSession, Advantages & disadvantages,use of URL HttpSession	To learn how to develop web applications using servlet	Develop web applications using servlet.	
Unit -3:- JSP Introduction to JSP, Advantages of JSP over Servlet, JSP architecture, JSP life cycle, Implicit objects in JSP- request, response, out, page, pageContext, application, session, config, exception, JSP tag elements- Declarative, Declaration, scriplet, expression, action., Java Bean- Advantages & Disadvantages, useBean tag-setProperty and getProperty, Bean In Jsp, JSTL core tag: General purpose tag, conditional tag,	How to develop web applications using JSP.	Develop web applications using JSP.	

networking tag, JSTL SQL tags, Custom tag: empty tag, body content tag, iteration tag, simple tag		
Unit -4:- Hibernate and Struts Introduction Hibernate(HB), Architecture of HB, Generator classes, Steps to create application of HB:- HB with annotation, Insert ,Delete,update,retrive records from database in HB, HB web application **Struts:-** Introduction to struts, What is struts, Use of struts, Features of Struts, Architecture of struts, Steps to create application of struts HDLC, Point to Point protocol.Multiple Access Protocol: ALOHA, CSMA, CSMA/CD,CSMA/CA Channelization, FDMA, TDMA, CDMA	To Understand concept of hibernate and struts.	To use the concept of hibernate and struts.

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COURSE OUTCOME

Name of Department: COMPUTER SCIENCE

2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Data Communication and Networking
SEM I / II / III / IV / V / VI	Sem VI
COURSE NUMBER (PAPER NUMBER)	Paper XVI
TITLE OF COURSE (NAME OF PAPER) Data Communication and Networking	

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1. Introduction to Data Communication & Networking Data Communication: Components, Data Flow, Protocols & Standards, Design Issues of Layers, Connection oriented and connection less services, Network models :- ISO-OSI reference model, TCP/IP reference model.	Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.	Describe the functions of each layer in OSI and TCP/IP model
Unit 2. Physical layer Signals: Analog & Digital Signals, Period, Frequency, Phase, Amplitude, Bandwidth, Bit Rate, Bit Length, Fourier analysis. Transmission Impairment: Attenuation, Distortion, Noise, Nyquiest Theorem, Shannon Capacity Theorem. Transmission Media:-Guided Media-Magnetic Media, Twisted Pair, Coaxial Cable, Fiber Optic Cable,Unguided Media:- Wireless- Radio Waves, Microwaves, Infrared, Satellite Communication Digital Transmission: Manchester & Differential Manchester Coding, Pulse Code Modulation Modulation:- Amplitude Modulation, Frequency Modulation, Phase Modulation Transmission Mode: Parallel, Serial, Synchronous Transmission, Asynchronous Transmission. Multiplexing- Frequency Division Multiplexing, Time Division Multiplexing, Wavelength Division Multiplexing. Switching- Circuit Switching, Message Switching, Packet Switching.	Acquire knowledge of Application layer and Presentation layer paradigms and protocols.	Explain the functions of Application layer and Presentation layer paradigms and Protocols.
Unit 3. Data link layer Error Detection & Correction: Types of Errors, Hamming Distance, Error Detection: Parity Check, Cyclic Redundancy Check, Checksum Check, hamming code Data Link Control: Framing, Flow & Error Control ,Protocols: Simplex, Stop and Wait, Stop and W ait ARQ, Go Back N ARQ, Selective repeat ARQ,	Study data link layer concepts, design issues, and protocols	Describe the functions of data link layer and explain the protocols.

Unit 4. Network layer , Transport, Session, Presentation & Application layers Network layer Design issues, Routing Algorithm: Optimality Principle, Shortest Path Routing, Distance Vector Routing, Link State Routing. Congestion Control Algorithm: General principle of congestion control, Congestion prevention policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets Network Devices-Hubs, Switches, Repeaters, Bridges, Routers, Gateways **Transport, Session, Presentation & Application layers** TCP/IP protocol suite :- UDP,TCP,SCTP, IP, RTP, FTP, DNS, TELNET, SMTP, POP, HTTP, WWW, SNMP,ARP, RARP.Data Compression:- Audio Compression, Video Compression	Read the fundamentals and basics of Physical layer, and will apply them in real time applications	Explain the types of transmission media with real time applications

COURSE OUTCOME

Name of Department: COMPUTER SCIENCE

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Advance Python
SEM I / II / III / IV / V / VI	Sem VI

COURSE NUMBER (PAPER NUMBER)	Paper XVII

TITLE OF COURSE (NAME OF PAPER) Advance Python	

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit - I:- Windows Applications using Tkinter GUI Programming GUI in Python, Advantages of GUI, Introduction to GUI library, Basic Operations using Tkinter, Root Window, Working with Containers: Frame, Canvas Layout Management, Events and Bindings, Font, Colors, drawing on Canvas (line, oval, rectangle, etc.)Widgets: Label, Button, Checkbutton, Entry, Listbox, Message, Radiobutton, Text, Spinbox, Scrollbar, Menu etc. Writing Python Programs for GUI applications	Windows application development in python using Tkinter.	Develop windows application in python using Tkinter library.
Unit - II:- Database Connectivity using MySQL Installation of MySQL Database Software, Installing MySQL Connector, Steps for Database Connectivity, Working with MySQL Database : Inserting, Retrieving, Deleting and Updating the data Working with Stored Procedure	MySql open source database	Basic and advance concept of MySql open source database.
Unit - III:- Web Application using Django What Is a Web Framework? The MVC Design Pattern, Django's History, Advantages of Django, Understanding Django environment, Installing Django, Setting Up a Database Django architecture, The Development Server, Django Commands Overview, Starting a Project, Django apps, Difference between app and project, The Project Structure, Setting Up Your Project,Create an Application Migration, Admin Panel. Views in Django, URL Routing, Template in Django, Models in Django, Forms in Django.	Web application development using Django framework.	Develop web application and web project using Django framework.
Unit - IV- XML and Networking Introduction to XML, XML Parser Architecture and API's, Parsing XML with SAX API's, Parsing XML with DOM API's **Network Programming:-** Introduction to Sockets Programming, Server Socket Methods, Client Socket Methods, IP Address, URL, TCP/IP Server, TCP/IP Client, Sending E-mail pplication	Concept of XML in python and network programming in Python	Understand Concept of XML in python and network programming in Python

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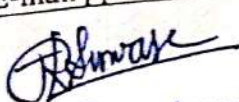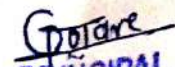Computer Science

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COURSE OUTCOME

Name of Department: COMPUTER SCIENCE

2022-23

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc.
NAME OF SUBJECT	Software Testing
SEM I / II / III / IV / V / VI	Sem VI
COURSE NUMBER (PAPER NUMBER)	Paper XVIII
TITLE OF COURSE (NAME OF PAPER)	Advance Python

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1:-Introduction To Software Testing: What is Software Testing?, Use or need of software testing. ,Software Development Life Cycle (SDLC) :- Water Fall Model, Spiral Model, V-Model, Prototype Model, Hybrid Model	Basic software debugging methods.	Investigate the reason for bugs and analyze the principles in software testing to prevent and remove bugs.
Unit- 2 White Box and Black Box Testing: Introduction to White box testing, Advantages and Disadvantages of White box testing, Loop Testing, Path Testing , Condition testing , Memory Testing , Performance Testing **Black Box Testing:** Introduction to black box testing , Advantages and Disadvantages of black box testing , unctional Testing- Integration Testing (Incremental Integration Testing) ,Top Down Incremental Integration Testing , Bottom Up Incremental Integration Testing , Non Incremental IntegrationTesting , System Testing , Acceptance Testing , Smoke Testing , Exploratory Testing , AdhocTesting , Performance Testing – Load Testing, Stress Testing, Volume Testing, Soak Testing, Regression Testing-Unit Regression Testing/Retest, Regional Regression Testing, Full Regression Testing	White box testing methods and techniques. Black Box testing methods and techniques.	Implement various test processes for quality improvement Design test planning.
Unit- 3 Test cases and its design Techniques: Introduction to Test Case , Characteristics Of Good Test Case , Test Case Template, How To WriteA Test Case, How To Ensure The Test Coverage Is Good , How To Identify whether It Is	Designing test plans	Manage the test process
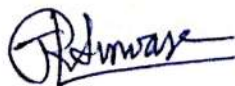
a GoodTest Case Or Not, Review Process/Peer Review , Preparing Review Report, Examples On WritingTest Cases, Test Cases DesigTechniques-Error Guessing, Equivalence Partitioning, Boundary Value Analysis		
Unit- 4 Software Test Life cycle and Defect Life Cycle: Software Test Life Cycle-Writing Test Plan, Preparing Traceability Matrix, Writing Test Execution Report, Summary Report, Retrospect Meeting /Triage Meetings, Defect Life Cycle-Concept of Defect life cycle, Difference between Bug, Defect, Failure, Error	Different testing tools (familiar with open source tools)	Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques.

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Name of Program: B.Sc. I

Name of Subject: Mathematics

Semester: Sem -I

Course No. / Paper No.: Paper I

Title of Course (Name of Paper): Algebra

Course content	Objectives	Outcomes
Matrices Symmetric and Skew symmetric, Elementary transformations, Rank of a Matrix(Echelon and Normal form), Characteristic equation of a matrix, Cayley Hamilton theorem and its use in finding the inverse of a matrix.	To introduce to student about types of matrices, rank of a matrix	The Students are able to use techniques for solving matrices
Linear Equations Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Eigen values and Eigen vectors.	To introduce to student about solution of simultaneous equations, Eigen values and Eigen vectors.	The Students are able to use matrices techniques for solving system of linear equations, Eigen values and Eigen vectors.
Complex Number Modulus and Argument of a Complex Number, DeMoivre's theorem and its applications, Roots of Unity, Roots of Complex Numbers.	To introduce to student about complex numbers, DeMoivre's theorem and its applications roots of unity and roots of complex number.	The Students are able to use techniques for solving complex roots of unity. s
Transcendental Functions Circular Function and their inverses and Hyperbolic function of a complex variable with their inverses. ons	To introduce to student about circular functions and their inverses, hyperbolic functions of a complex number.	The student can understood the transcendental functions.

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Name of Program: B.Sc. I

Name of Subject: Mathematics

Semester: Sem I

Course No. / Paper No.: Paper II

Title of Course (Name of Paper): Calculus

Course content	Objectives	Outcomes
Differentiation: Indeterminate forms and L' Hospital's Rule, Successive differentiations, nth derivatives of standard functions, Leibnitz rule. Taylor's theorem and Maclaurin's Theorem (Only Statements). Series expansions of , cos x, sin x, $(1+x)^n$, log(1+x).	To introduce to student about Indeterminate forms of limit, L' Hospital's Rule, Successive differentiations, nth derivatives of standard functions, Leibnitz rule. Taylor's theorem and Maclaurin's Theorem.	The Students can express the power series expansion of a given function and evaluate limits
Function of two variables: Limit and Continuity of functions of two variables, Partial derivative, partial derivative of higher orders, Homogeneous functions, Euler's theorem on Homogeneous functions.	To introduce to student about limits and continuity of two variables, partial derivatives and its higher orders , homogeneous functions, Euler's theorem.	The Students will able to solve limits, partial derivatives of functions of two variables
Reduction formulae: $\int_0^{\pi/2} \sin x \, dx, \int_0^{\pi/2} \cos x \, dx$, $\int_0^{\pi/2} \sin x \cos x \, dx$	To introduce to student about integration of sine and cosine formulae for higher degree.	The Students are able to use techniques for solving integration of sine and cosine
Vector Calculus: Scalar point function, Vector point function, Directional derivative, Gradient , divergence and Curl and its properties.	To introduce to student about vector differentiation with vector differential operator.	The Students will able to use different vector differential operator

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Shelgaon(R) Tal-Barshi

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COURSE OUTCOME

NAME OF DEPARTMENT : MATHEMATICS

Name of Program: B.Sc. I

Name of Subject: Mathematics

Semester: Sem-II

Course No. / Paper No.: Paper III

Title of Course (Name of Paper): Geometry

Course content	Objectives	Outcomes
Change of Axis Translations, Rotations, Invariants, Identifications of conics from general form of second degree equations, Polar Coordinates, Conversion formulae.	1.To introduce to student about change of axis.	1.The student will understood the change of axis.
Plane General equation of plane, Normal equation, Intercept form Angle between two planes, Plane through three points, Plane through a given point, Sides of a plane, Distance of a point from a plane, Family of planes.	2. To introduce to student about plane.	2. The student will understood the plane.
Sphere Centre radius form, General form , Diameter form, Equation of Tangent Plane and condition for tangency, Family of spheres $S + \lambda s' = 0$, $S + \lambda P = 0$	3. To introduce to student about sphere.	3. The student will understood the sphere.

Signature of Lecturer

Head of the Department
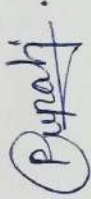Mathematics

Signature of HOD

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COURSE OUTCOME
NAME OF DEPARTMENT : MATHEMATICS

Name of Program: B.Sc. I

Name of Subject: Mathematics

Semester: Sem -II

Course No. / Paper No.: Paper IV

Title of Course (Name of Paper): Differential Equation

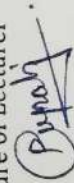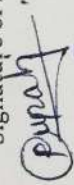| Course content	Objectives	Outcomes
Differential Equations of first order and first degree:[Part-I] : Variables separable, Homogeneous, non- homogeneous differential equations.	To introduce to student about some method to find solutions of first order and first degree.	The Students will able to solve first order and first degree.
Differential Equations of first order and first degree :[Part-II] : Exact differential equations. Necessary and sufficient condition for exactness, Integrating factor with four rules, Linear differential equations of the form: $\frac{dy}{dx} + Py = Q$ Bernoulli's Equation $\frac{dy}{dx} + Py = Q\, y^n$	To introduce to student about some method to find solutions of first order and first degree.	The Students will able to solve first order and first degree.
Linear Differential Equations With Constant Coefficients :[Part-I] Complementary function and particular integral, General solution of f(D) y=X, Solution of f(D)y=0 for non-repeated , repeated, real and complex root.	To introduce to student about some method to find solutions of Linear differential equations with constant coefficients.	The Students will able to use techniques for solving Linear differential equations with constant coefficients.
Linear Differential Equations With Constant Coefficients : [Part-II] Solution of f(D)y=X, where X is of the form e^{ax} , sin(ax), cos (ax),x^m , V, xV.	To introduce to student about some method to find solutions of Linear differential equations with constant coefficients	The Students will able to use techniques for solving Linear differential equations with constant coefficients.

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PROGRAM SUBJECT OUTCOME
NAME OF DEPARTMENT : MATHEMATICS

Name of Program: B.Sc. I		
Name of Subject: Mathematics		
Semester: Sem I		
Course No. / Paper No.: Paper I		
Title of Course (Name of Paper): Algebra		

Course content	Objectives	Outcomes
Matrices : Symmetric and Skew symmetric, Elementary transformations, Rank of a Matrix(Echelon and Normal form), Characteristic equation of a matrix, Cayley Hamilton theorem and its use in finding the inverse of a matrix. **Linear Equations :** Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Eigen values and Eigen vectors. **Complex Number :** Modulus and Argument of a Complex Number, De Moivre's theorem and its applications, Roots of Unity, Roots of Complex Numbers. **Transcendental Functions :** Circular Functions and their inverses and Hyperbolic function of a complex variable with their inverses.	1.To introduce to student about types of matrices rank of a matrix. 2. To introduce to student about solution of simultaneous Equations Eigen values and Eigenvectors. 3. To introduce to student about complex numbers, De Moivre's theorem and its applications roots of unity and roots of complex number. 4. To introduce to student about circular functions and their inverses, hyperbolic functions of a complex number.	1.The Students are able to use techniques for solving matrices. 2.The Students are able to use matrices techniques for solving system of linear equations, Eigen values and Eigen vectors. 3. The Students are able to use techniques for solving complex roots of unity. 4. The student can understood the transcendental functions.

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| Name of Program: B.Sc. I |
| Name of Subject: Mathematics |
| Semester: Sem I |
| Course No. / Paper No.: Paper II |
| Title of Course (Name of Paper): Calculus |

Course content	Objectives	Outcomes
Differentiation: Indeterminate forms and L' Hospital's Rule, Successive differentiations, nth derivatives of standard functions, Leibnitz rule. Taylor's theorem and Maclaurin's Theorem (Only Statements). Series expansions of , cos x, sin x, $(1+x)^n$, log(1+x). **Function of two variables:** Limit and Continuity of functions of two variables, Partial derivative, partial derivative of higher orders, Homogeneous functions, Euler's theorem on Homogeneous functions. **Reduction formulae:** $\int_0^{\pi/2} \sin x\, dx, \int_0^{\pi/2} \cos x\, dx ,$ $$\int_0^{\pi/2} \sin x \cos x\, dx$$ **Vector Calculus:** Scalar point function, Vector point function, Directional derivative, Gradient , divergence and Curl and its properties.	1.To introduce to student about Indeterminate forms of limit, L' Hospital's Rule, Successive differentiations, nth derivatives of standard functions, Leibnitz rule. Taylor's theorem and Maclaurin's Theorem. 2. To introduce to student about limits and continuity of two variables, partial derivatives and its higher orders , homogeneous functions, Euler's theorem. 3. To introduce to student about integration of sine and cosine formulae for higher degree. 4. To introduce to student about vector differentiation with vector differential operator.	1. The Students can express the power series expansion of a given function and evaluate limits. 2. The Students will able to solve limits, partial derivatives of functions of two variables. 3. The Students are able to use techniques for solving integration of sine and cosine. 4. The Students will able to use different vector differential operator

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Name of Program: B.Sc. I
Name of Subject: Mathematics
Semester: Sem-II
Course No. / Paper No.: Paper III
Title of Course (Name of Paper): Geometry

Course content	Objectives	Outcomes
Change of Axis : Translations, Rotations, Invariants, Identifications of conics from general form of second degree equations, Polar Coordinates, Conversion formulae. **Plane :** General equation of plane, Normal equation, Intercept form Angle between two planes, Plane through three points, Plane through a given point, Sides of a plane, Distance of a point from a plane, Family of planes. **Sphere :** Centre radius form, General form , Diameter form, Equation of Tangent Plane and condition for tangency, Family of spheres S + λ s ' =0, S +λ P=0	1.To introduce to student about change of axis. 2. To introduce to student about plane. 3. To introduce to student about sphere.	1. The student will understood the change of axis. 2. The student will understood the plane. 3. The student will understood the sphere.

Signature of Lecturer   Signature of HOD   PRINCIPAL   Page 4

Name of Program: B.Sc. I

Name of Subject: Mathematics

Semester: Sem -II

Course No. / Paper No.: Paper IV

Title of Course (Name of Paper): Differential Equation

Course content	Objectives	Outcomes
Differential Equations of first order and first degree:[Part-I] : Variables separable, Homogeneous, non- homogeneous differential equations. **Differential Equations of first order and first degree :[Part-II] :** Exact differential equations. Necessary and sufficient condition for exactness, Integrating factor with four rules, Linear differential equations of the form: $\frac{dy}{dx} + Py = Q$ Bernoulli's Equation $\frac{dy}{dx} + Py = Q\, y^n$ **Linear Differential Equations With Constant Coefficients :[Part-I]** Complementary function and particular integral, General solution of f(D) y=X, Solution of f(D)y=0 for non-repeated , repeated, real and complex root. **Linear Differential Equations With Constant Coefficients : [Part-II]** Solution of f(D)y=X , where X is of the form e^{ax} , sin(ax), cos(ax), x^m , V, xV	1.To introduce to student about some method to find solutions of first order and first degree. 2. To introduce to student about some method to find solutions of first order and first degree. 3. To introduce to student about some method to find solutions of Linear differential equations with constant coefficients. 4. To introduce to student about some method to find solutions of Linear differential equations with constant coefficients	1.The Students will able to solve first order and first degree. 2. The Students will able to solve first order and first degree. 3. The Students will able to use techniques for solving Linear differential equations with constant coefficients. 4.The Students will able to use techniques for solving Linear differential equations with constant coefficients.

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Tuljabhavani Mahila Mandal's

Hemuji Chandele College, Shelgaon (R),

Tal. Barshi, Dist. Solapur (Maharashtra) 413222

Name Department:

[B.Sc.Botany)

Program Outcome [B.Sc. Botany]

- Students have scope in forestry
- Students can build their tissue culture lab
- Students can start to grow plants for nursery
- Students can apply for various examinations of MPSC & UPSC
- Students can build up their research carrier in field of Botany
- Students can build up their research carrier in field of Taxonomy of plants
- Students can build up their research carrier in field of plant breeding
- Students can be able to follow new methodology for plant growth and propagation.
- Students can apply new methodologies in farm for better yield.
- Students can prepare pestisides, perfumes, herbal medicines, cosmetics by using various plant sources.
- Students get basic knowledge about algae, bryophytes, fungi, pteridophytes and gymnospermic plants.
- Students will get criteria of plant classification, identification and nomenclature of plants.
- Students will get appropriate knowledge about concepts in enzymology, biomolecules and cell biology.
- Students will get knowledge about bioinstrumentation
- Students will get detail knowledge about applications of different instruments in industry.
- Students will get detail knowledge about ethenobotany of plants.
- Students get basic knowledge about basic concepts in biostat.
- Students get basic knowledge about medalian and human genetics.of plant classification, identification and nomenclature of plants.
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Head of the Department
Botany

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Tal. Barshi, Dist. Solapur (Maharashtra) 413222

COURSE OUTCOME

Name of Department - Botany

. – B.Sc. 1st		
NAME OF SUBJECT - Botany		
SEM I / II / III / IV		
COURSE NUMBER (PAPER NUMBER) - I		
TITLE OF COURSE (NAME OF PAPER)- **Microbiology and Phycology**		
COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1 : Introduction of Microbiology	To get the knowledge about the basic concepts in microbiology.	The student can understand the basic concept of microbiology.
Unit 2: Viruses: General characters, structure, classification (plant, animal and bacterial viruses) and economic importance of viruses.	To get the knowledge about the characters, structure and economic importance of viruses.	The student can understand in detail about the viruses.
Unit 3: Bacteria: Characteristics of bacteria, size, forms (Shapes), ultra structure of bacterial cell, Economic importance.(Useful and harmful).	To get the knowledge about the forms, size and diversity of bacteria.	The student can understand in detail about the bacteria.

Unit 4 : Mycoplasma: (Phytoplasma and Spiroplasma) Characters, Structure, classification and significance	To get the knowledge about the Mycoplasma	The student can understand in detail about the Mycoplasma
Unit 5 : Algae: 5.1 General characters and classification of algae (As per Smith-	To get the knowledge about the characters, classification and reproduction of algae.	The student can understand in detail about the algae

55) up to class. Range of thallus organization Methods of reproduction		
Unit 6 : Cyanophyta: General Characters of Cyanophyta Study of *Nostoc* – Occurrence, Classification, thallus structure and reproduction	To get the knowledge about the Characters, occurrence & reproduction of Cyanophyta division of algae	The student can understand in detail about the division Cyanophyta
Unit 7 : Chlorophyta: General Characters of Chlorophyta Study of *Spirogyra* - Occurrence, Classification, thallus structure and reproduction	To get the knowledge about the Characters, occurrence & reproduction Chlorophyta division of algae	The student can understand in detail about the division Chlorophyta
Unit 8 : Phaeophyta: General Characters of Phaeophyta Study of *Sargassum* - Occurrence, Classification, thallus structure and reproduction (excluding developmental details of sex organs and sporophyte)	To get the knowledge about the Characters, occurrence & reproduction in Phaeophyta division of algae	The student can understand in detail about the division Phaeophyta

Unit 9		
9.1 : Applied Phycology: Role of algae in the environment, agriculture, biotechnology and industry	To get the knowledge about the application of algae in various field.	The student can understand in detail about the importance & uses of algae.

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COURSE OUTCOME

. – B.Sc. -I

NAME OF SUBJECT - Botany

SEM   I / II / III – IV -I

COURSE NUMBER (PAPER NUMBER) - II

TITLE OF COURSE (NAME OF PAPER)- FUNGI and ARCHEGONIATE (Bryophytes,Pteridophytes, Gymnosperms)

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Introduction 1.1 Unifying characters of archegoniates and Alternation of generations.	To get the knowledge about the general introduction of Archegoniates.	The student can understand about the general introduction of Archegoniates.
Unit 2: Bryophytes 2.1 General characteristics and Classification (As per G. M. Smith); Study of *Riccia* with respect to occurrence, classification, thallus structure and reproduction (without developmental stages) Economic importance	To get the knowledge about the Bryophytes with suitable example.	The student can understand about the Bryophytes and life cycle of *Riccia.*

Unit 3: Pteridophytes
   General characteristics and classification, up to class (as per smith).
   Study of *Selaginella* with respect to occurrence, classification morphology of sporophyte, anatomy (stem) and reproduction (without developmental stages)
   Economic importance
	To get the knowledge about the Pteridophytes with suitable example.	The student can understand about the Pteridophytes and life cycle of *Selaginella.*

Unit 4: Gymnosperms 4.1: General characteristics and classification (Sporne) 4.2: Study of *Cycas* with respect to occurrence, classification, morphology, sporophyte and Corolloid roots. Anatomy of Leaf and corolloid root and reproduction-structure of male cone and megasporophyll (without developmental stages) 4.3 : Economic importance	To get the knowledge about the Gymnosperms with suitable example.	The student can understand about the Gymnosperms and life cycle of *Cycas.*

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COURSE OUTCOME

Name of Department - Botany

. : B.Sc.I		
NAME OF SUBJECT	: Botany	
SEM I / II / III / IV /	: II	
COURSE NUMBER (PAPER NUMBER) : III		
TITLE OF COURSE (NAME OF PAPER) : **PLANT ECOLOGY**		
COURSE CONTENT	OBJECTIVES	OUTCOME
Unit-1 - **Introduction** 1.1) Climatic factors 1.2) Edaphic factors	To get the knowledge about the climatic and Edaphic factors of environment.	The student can understand about the Climatic and Edaphic factors of environment.
Unit-2 **Community Ecology-** 2.1) Form and structure of communities 2.2) Classification and Physiognomy. 2.3) Community characteristics	To get the knowledge about the Community ecology.	The student can understand about the Community ecology.
Unit-3 **Ecosystems** 3.1) Concept and types 3.2) Components and Organization of ecosystem 3.3) Ecological pyramids, Food chains and food webs.	To get the knowledge about the ecosystem.	The student can understand about the Concept , types, various ecological pyramids and various biogeochemical

Energy flow in ecosystem. Biogeochemical cycles – Nitrogen, Oxygen, Carbon		cycles.
Unit-4 **Ecological Succession** 4.1) Concept and process 4.2) Primary and Secondary succession 4.3) Hydrosere and xerosere	To get the knowledge about the Ecological succession.	The student can understand about the Ecological succession.
Unit-5 **Ecological adaptations** 5.1) Concept 5.2) Xeric, Hydric and Mesic adaptations	To get the knowledge about the Ecological adaptations.	The student can understand about the Ecological adaptations in plants.
Unit-VI-**Pollution :-** 6.1)Introduction 6.2) Air pollution-Sources of air pollutants, their effects and control measures. 6.3) Water pollution- Sources of water pollutants, their effects and control measures.	To get the knowledge about the air pollution and water pollution.	The student can understand about the Air and water pollution.l

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COURSE OUTCOME

Name of Department - Botany

: B.Sc. I		
NAME OF SUBJECT : Botany		
SEM I / II / III / IV : II		
COURSE NUMBER (PAPER NUMBER) : IV		
TITLE OF COURSE (NAME OF PAPER) : & Taxonomy of Angiosperms		
COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Apical meristem: Introduction & Classification of meristems , Functions of meristem , Theories of structural development- The Apical cell theory Histogen theory Tunica corpus theory	To get the knowledge about the meristem in plants.	The student can understand about the Meristamatic tissue in plants.
Unit 2 : Permanent tissues: Structure and functions of simple tissues, Structure and functions of complex tissues. Types of vascular bundles.	To get the knowledge about the permanent tissues in plants.	The student can understand about the permanent tissue in plants.
Unit 3 : Tissue system and their functions:	To get the knowledge about	The student can understand about the

Epidermal tissue System , Secretary Tissue System, Mechanical tissue System	the tissue system and their function in plants.	tissue system in plants.
Unit 4 : Secondary body of the plant: Normal secondary growth in Dicot root and Stem. Periderm, Lenticels and annual rings. Basic structure of wood and its types.	To get the knowledge about the Secondary body of the plant.	The student can understand about the Secondary body plants.
Unit 5: Taxonomy of Angiosperms: Morphology of Inflorescence, Flower, Fruit. Study of Angiosperm families with respect to classification, morphology of vegetative & reproductive parts, floral formula, floral diagram, diagnostic features and economic importance. 1.Combretaceae 2.Asclepidaceae 3.Amaranthaceae 4.Liliaceae	To get the knowledge about the Taxonomy of angiosperms.	The student can understand about the taxonomy of angiosperms.

COURSE OUTCOME

Name of Department - Botany

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc.
NAME OF SUBJECT : Botany
SEM I / II / III / IV / V / VI : III
COURSE NUMBER (PAPER NUMBER) : V
TITLE OF COURSE (NAME OF PAPER) : Plant Anatomy

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Apical meristem: Introduction & Classification of meristems , Functions of meristem , Theories of structural development- The Apical cell theory Histogen theory Tunica corpus theory	To get the knowledge about the meristem in plants.	The student can understand about the Meristamatic tissue in plants.
Unit 2 : Permanent tissues: Structure and functions of simple tissues, Structure and functions of complex tissues Types of vascular bundles.	To get the knowledge about the permanent tissues in plants.	The student can understand about the permanent tissue in plants.
Unit 3 : Tissue system and their functions: Epidermal tissue System , Secretary Tissue System, Mechanical tissue System	To get the knowledge about the tissue system and their function in plants.	The student can understand about the tissue system in plants.

Unit 4 : Secondary body ofthe plant: Normal secondary growth inDicot root and Stem. Periderm, Lenticels andannual rings. Basic structure of wood andits types.	To get the knowledge about the Secondary body of the plant.	The student can understand about theSecondary body plants.
Unit 5:-Tissue System **Epidermal tissue system** **Secrerary tissue system** **Mechanical tissue system**	knowledge about **Tissue System**	understand about the **Tissue System**

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COURSE OUTCOME

B.A. / B.Sc. / M.A. / M.Sc. – B.Sc.		
NAME OF SUBJECT - Botany		
SEM I / II / III / IV / V / VI- **III**		
COURSE NUMBER (PAPER NUMBER) - **VI**		
TITLE OF COURSE (NAME OF PAPER)- : **Plant Metabolism**		
COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: ATP-Synthesis 1.1: Introduction. 1.2: Structure of ATP molecule. 1.3: Mechanism of ATP synthesis. (Oxidative and photophosphorylation). 1.4: ATP synthase, Boyers conformational model, Racker's experiment, Jagendorf's experiment.	To get the knowledge about the ATP synthesis in plants.	The student can understand about ATP synthesis in plants.
Unit 2: Carbon Oxidation 2.1: Introduction. 2.2: Glycolysis. 2.3: Pentose phosphate pathway. 2.4: oxidative decarboxylation of pyruvate. 2.5: Regulation of PDH, NADH shuttle. 2.6: TCA cycle. 2.7: Mitochondrial electron transport. 2.8: oxidative phosphorylation. 2.9: cyanide-resistant respiration.	To get the knowledge about the carbon oxidation.	The student can understand about carbon oxidation
Unit 3: Carbohydrate Metabolism 3.1: Introduction and broad classification. 3.2: Monosaccharides: Properties and Examples: Trioses, Tetroses, Pentoses and Hexoses.	To get the knowledge about the carbohydrate metabolism.	The student can understand about carbohydrate metabolism.

3.3: Oligosaccharides: Properties and Examples: Sucrose, Maltose and Lactose. 3.4: Polysaccharides— Properties and Examples— Starch and Cellulose. : Isomers, enantiomers and epimers. : Biosynthesis of sucrose and starch. : Degradation of sucrose and starch.		
Unit 4: Lipid Metabolism **4.1:** Introduction and classification. 4.2: Saturated fatty acids— properties and examples— Stearic and palmitic acids. 4.3: Unsaturated fatty acids-- Properties and Examples— Linoleic and linolenic acids. 4.4: General outline of fatty acid biosynthesis. : Beta oxidation of fatty acids. : Gluconeogenesis of fatty acids during germination. : Properties and significance of lipids.	To get the knowledge about the lipid metabolism	The student can understand about lipid metabolism

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COURSE OUTCOME

B.A. / B.Sc. / M.A. / M.Sc. : **B.Sc.**
NAME OF SUBJECT : Botany
SEM   I / II / III / IV / V / VI   : IV
COURSE NUMBER (PAPER NUMBER)   : **VII**
TITLE OF COURSE (NAME OF PAPER): **Plant Physiology**

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Photosynthesis: Introduction and significance Photosynthetic apparatus Photosynthetic pigments, accessory pigments Photosystems – reaction center complexes Light reaction-cyclic and non-cyclic Dark reactions Calvin cycle, C4 cycle CAM.	To get the knowledge about the photosynthesis.	The student can understand about the How photosynthesis process carry out in plants.
Unit 2: Nitrogen metabolism Introduction Nitrogen cycle Biological N2 fixation – Definition, types & organisms involved Mechanism of Biological Nitrogen fixation Significance of Biological Nitrogen fixation.	To get the knowledge about the Nitrogen metabolism.	The student can understand about the Nitrogen metabolism.

Unit 3: Genetics- 3.1: Introduction, terminology 3.2: Mendelism- History 3.3: Principles of inheritance- Low of dominance, Law of purity of gametes, Law of independent assortment. 3.4: Gene interaction- Definition, types- complementary, supplementary and inhibitory genes.	To get the knowledge about the basic concepts and principles of genetics.	The student can understand about the Basic concepts and principles of genetics.
Unit 4:Classical genetics 4.1: Linkage-Definition, kinds of linkage-complete, incomplete and linkage groups, Significance of linkage. 4.2: Crossing over-definition, Mechanism of crossing over, Break and exchange theory, Significance of crossing over.	To get the knowledge about the linkage and crossing over.	The student can understand about the Linkage and crossing over.
Unit 5: Multiple allelism- 5.5: Introduction and definition 5.2: Eye color in Drosophila 5.3: Blood groups in man 5.4: Self incompatibility in plant.	To get the knowledge about the multiple alleles.	The student can understand about the Multiple alleles.

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COURSE OUTCOME

. – B.Sc-II
NAME OF SUBJECT - Botany
SEM   I / II / III / IV- IV
COURSE NUMBER (PAPER NUMBER) - VIII
TITLE OF COURSE (NAME OF PAPER)- Embryology of Angiosperm

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1: Structural Organization of Flower : Induction of flowering. : Flower as a modified determinate shoot.	To get the knowledge about the flower development	The student can understand about the development of flower.
Unit 2: Pollination and fertilization 2.1: Anther wall: Structure and functions. 2.2: Microsporogenesis. : Callose deposition and its significance. : Male Gametophyte Development. : NPC system (in brief). : Palynology and scope (a brief account of Melisopalynology).	To get the knowledge about the anther and pollen biology.	The student can understand about anther and pollen biology.

: Structure; Types of ovule. : Megasporogenesis, Female gametophyte (Embryo sac). : Female gametophyte development - Monosporic, Bisporic and Tetrasporic.	To get the knowledge about the structure, types and development of embryo sac in ovule	The student can understand about the ovule.
: : Pollination types and significance. : Structure of stigma and style. : Path of pollen tube in pistil. : Double fertilization.	To get the knowledge about the pollination and fertilization in plants.	The student can understand about the pollination and fertilization.
Unit 3: Embryo, Endosperm development : Introduction. : Structure and types of endosperm. : Structure of monocot and dicot seed. 5.4. Seed dispersal.	To get the knowledge about the structure of embryo and endosperm	The student can understand about the embryo and endosperm.
Unit 4:Seed and Fruit dispersal :Introduction Agent and mechanism of seed and fruit dispersal	To get the knowledge about the dispersal of seed and fruit	The student can understand about the dispersal of seed and fruitS

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Head of the Department
Botany

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Name Department: CHEMISTRY

Program Outcome [B.Sc. Chemistry]

- Obtain knowledge with facts and findings related to chemistry
- Understands the fundamental concept, principles and working of theories
  related to scientificphenomena
- Gain enough skill in handling instruments, planning and execution of innovative experimen
- Obtain the observations and drawing logical answers from the conducted experiments.
- Able to do creative thinking and put the conclusions based on scientific findings.
- Develop the critical thinking ability and analytical mindset.
- Realize the knowledge of the subject and utilize it for the benefit of the human mankind.

Name of Department: Chemistry

B.Sc.I	
NAME OF SUBJECT: Physical Chemistry	
SEM I	
COURSE NUMBER (PAPER NUMBER): P-I	
TITLE OF COURSE (NAME OF PAPER): Physical Chemistry	

COURSE CONTENT	OBJECTIVES	OUTCOME
Chemical kinetics Chemical Kinetics and it's scope, Rate of reaction, Definition and units of rate constant. Factors affecting rate of reaction. Concentration, pressure, temperature and catalyst. Order and Molecularity of reaction. First order reaction: Derivation of Rate constant. Characteristics of first order reaction. Examples: Decomposition of N_2O_5 Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants. Characteristics of Second order reaction. Examples :i) Reaction between $K_2S_2O_8$ and KI . Pseudo-unimolecular reactions such as Hydrolysis of methyl acetate in presence of Acid. Methods to determine the order of reaction:	**TO know the basic concept of** Chemical Kinetics and it's scope, Rate of reaction, Definition and units of rate constant. Factors affecting rate of reaction. Concentration, pressure, temperature and catalyst. Order and Molecularity of reaction. First order reaction: Derivation of Rate constant. Characteristics of first order reaction. Examples: Decomposition of N_2O_5 Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants. Characteristics of Second order reaction. Examples :i) Reaction between $K_2S_2O_8$ and KI . Pseudo-unimolecular reactions such as Hydrolysis of methyl acetate in presence of Acid. Methods to determine the	**Students should understand** Chemical Kinetics and it's scope, Rate of reaction, Definition and units of rate constant. Factors affecting rate of reaction. Concentration, pressure, temperature and catalyst. Order and Molecularity of reaction. First order reaction: Derivation of Rate constant. Characteristics of first order reaction. Examples: Decomposition of N_2O_5 Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants. Characteristics of Second order reaction. Examples :i) Reaction between $K_2S_2O_8$ and KI . Pseudo-unimolecular reactions such as Hydrolysis of methyl acetate in presence of Acid. Methods to determine the order of reaction:

a) Integration method, b) Graphical method c) Half change method, d) Ostwald's isolation method (Numerical Problems Expected)	order of reaction: a) Integration method, b) Graphical method c) Half change method, d) Ostwald's isolation method (Numerical Problems Expected)	a) Integration method, b) Graphical method c) Half change method, d) Ostwald's isolation method (Numerical Problems Expected)ents should under stand the basic concept like
Mathematical concept Graphical representation : Graph paper, co-ordinates of a point, equation of straight line and intercept, plotting of graph based on experimental data. Derivative : Rules of differentiation (without proof) pertaining to algebraic and exponential functions. Example related to chemistry. Integration : Rules of Integration (without proof) pertaining to algebraic and exponential functions. Example related to chemistry. (Numerical Problems not expected)	**To develop a skill of solving Numerical Problems.** Graphical representation : Graph paper, co-ordinates of a point, equation of straight line and intercept, plotting of graph based on experimental data. Derivative : Rules of differentiation (without proof) pertaining to algebraic and exponential functions. Example related to chemistry. Integration : Rules of Integration (without proof) pertaining to algebraic and exponential functions. Example related to chemistry. (Numerical Problems not expected)	**Students should increase the ability of solving Numerical Problems.** Graphical representation : Graph paper, co-ordinates of a point, equation of straight line and intercept, plotting of graph based on experimental data. Derivative : Rules of differentiation (without proof) pertaining to algebraic and exponential functions. Example related to chemistry. Integration : Rules of Integration (without proof) pertaining to algebraic and exponential functions. Example related to chemistry. (Numerical Problems not expected)
Thermodynamics 3.1 Spontaneous and non spontaneous processes, Second law of thermodynamics and its different statements. 3.2 Carnot's Theorem (Heat engine), Carnot cycle and its efficiency. (Numerical Problems Expected4.1 a) **Gaseous State** Ideal and Non ideal gases, b) Deviation from ideal behaviour. (Only Boyle's law) c) Causes of deviation, van der Waal's equation, explanation	**To understand the basic concept like** 3.1 Spontaneous and non spontaneous processes, Second law of thermodynamics and its different statements. 3.2 Carnot's Theorem (Heat engine), Carnot cycle and its efficiency. (Numerical Problems Expected **To understand the basic**	**Students Should understand the basic concepts in Thermodynamics.** 3.1 Spontaneous and non spontaneous processes, Second law of thermodynamics and its different statements. 3.2 Carnot's Theorem (Heat engine), Carnot cycle and its efficiency. (Numerical Problems Expected **Students Should understand the basic concepts in** Ideal and Non ideal gases, b)

| of real gas behavior by van der Waal's equation. Critical Phenomena : PV-Isotherms of real gases (Andrew's isotherms), continuity of state, Relationship between critical constants and van der Waal's constants. Liquification of gases, Joule-Thomson effect. (Numerical Problems expected) | concept like Ideal and Non ideal gases, b) Deviation from ideal behaviour. (Only Boyle's law) c) Causes of deviation, van der Waal's equation, explanation of real gas behavior by van der Waal's equation. 4.2 Critical Phenomena : PV-Isotherms of real gases (Andrew's isotherms), continuity of state, Relationship between critical constants and van der Waal's constants. 4.3 Liquification of gases, Joule-Thomson effect. (Numerical Problems expected) | Deviation from ideal behaviour. (Only Boyle's law) c) Causes of deviation, van der Waal's equation, explanation of real gas behavior by van der Waal's equation. 4.2 Critical Phenomena : PV-Isotherms of real gases (Andrew's isotherms), continuity of state, Relationship between critical constants and van der Waal's constants. 4.3 Liquification of gases, Joule-Thomson effect. (Numerical Problems expected) |

Principal

Hemuji Chandele College
Shelgaon(R) Tal-Barshi Dist-Solapur

Signature of HOD
Head of the Department
Chemistry

B.A. / B.Sc. / M.A. / M.Sc.	: B.Sc. I
NAME OF SUBJECT	: Inorganic Chemistry
SEM I / II / III / IV / V / VI	: Sem. I
COURSE NUMBER (PAPER NUMBER)	: P-II
TITLE OF COURSE (NAME OF PAPER)	: Inorganic Chemistry

COURSE CONTENT	OBJECTIVES	OUTCOME
1. Atomic Structure and periodic properties 1.1 Atomic Structure a) Shapes of s, p, d orbital's. b) Aufbau and Pauli's exclusion principle, Hund's rule of maximum multiplicity c) General electronic configuration of s and p	Students should get knowledge about structure and periodical properties of Atoms.	Students have understood about the atomic structure, electronic configuration, and periodical properties of Atoms from s and

		p block elements.
block elements. 1.2 General Characteristics of s and p block elements w.r.t. Atomic and Ionic radii, Ionization energy, Electron affinity, Electronegativity, Reactivity, Melting and Boiling point		
2. Chemical bonding and Ionic Solids 2.1 Types of chemical bonding 2.2 Ionic Bonding a) Formation of ionic bond, Energetics of ionic bonding : Ionisation potential, Electron affinity and Lattice energy. b) Characteristics of ionic compounds. c) Born-Haber Cycle for Alkali metal halide (NaCl). d) Fajan's rules. 2.3 Radius ratio and crystal structure. a) Definition: Radius ratio (r+ / r-), Coordination number, Stoichiometry and unit cell. b) Concept and calculation of radius ratio (r+ / r-) for ionic solid with octahedral geometry. c) Radius ratio effect on geometry. d) Crystal structure of NaCl and CsCl w.r.t. unit cell, radius ratio, coordination number and stoichiometry.	Students should get knowledge about Chemical bonding and crystal structure of ionic solids.	Students have understood about; How the chemical bonds are formed and what are their types. Stability of crystal structure, Internal structure of ionic solids like NaCl, CsCl etc.
3. Covalent bonding: Valence Bond Theory (VBT) Approach 3.1 Valence Bond Theory: Heitler–London Theory and Pauling-Slater Theory 3.2 Limitations of VBT 3.3 Need of Hybridization 3.4 Types of hybridization and shapes of simple inorganic molecules: $BeCl_2$, BF_3, $SiCl_4$, PCl_5, SF_6, IF_7. 3.5 Valence Shell Electron Pair Repulsion (VSEPR) Theory w.r.t. NH_3, H_2O, ClF_3	Students should get knowledge about hybridization concept, structure and bonding in covalent inorganic compounds.	Students have understood about formation of diatomic molecules, concept of hybridization, structure and bonding in covalent inorganic compounds.
4. Covalent bonding: Molecular Orbital Theory (MOT) Approach Atomic and Molecular orbitals. L.C.A.O. Principle 4.3 Bonding, Antibonding and Nonbonding Molecular orbitals. 4.4 Conditions for successful overlap 4.5 Different types of overlap (s-s, s-px, px -	Students should get knowledge about formation of molecular orbital's, bonding and characteristics of simple diatomic molecules.	Students have understood about construction of molecular orbital's and there use for the explanation of bonding and characteristics

px and py- py or pz- pz)
4.6 Energy level sequence of molecular orbitals for $n = 1$ and $n = 2$
4.7 M. O. Diagrams for: a) Homonuclear diatomic molecule. H_2, Li_2, Be_2, C_2, N_2 and O_2
b) Heteronuclear diatomic molecules CO and NO w.r.t. bond order
stability and magnetic properties.

(Magnetic behavior and stability) in simple diatomic molecules,
Concept of electron deficient bonding (2C-1e, 3C-2e etc.)

Dolare
Principal
Hemuji Chandele College
Shelgaon(R) Tal-Barshi Dist-Solapur

Bachute
Head of the Department
Signature of HOD
Chemistry

B.Sc. I

NAME OF SUBJECT: Organic Chemistry

SEM   II

COURSE NUMBER (PAPER NUMBER) P-III

TITLE OF COURSE (NAME OF PAPER): OrganicChemistry

COURSE CONTENT	OBJECTIVES	OUTCOME
1. Fundamentals of organic reaction mechanism 1.1 Meaning of reaction mechanism. 1.2 Curved arrow notation, Half headed and double headed arrows. 1.3 Types of bond breaking :Homolytic and Heterolytic. 1.4 Types of reagents : Electrophilic and Nucleophilic. 1.5 Types and sub-types of following organic reactions with definition and at least one example of each. a) Substitution b) Addition c) Elimination d) Rearrangement. (Mechanism is not expected) 1.6 Reactive Intermediates with examples carbocations, carbanions (formation, structure,	**To study** Meanings of terms involved in organic reactions like arrow notations, types of bonding, Types of reagents and intermediates formed in the reactions.	**Students gain in understanding of :** Basic terms involved in the organic reactions. Types and subtypes of reactions, reagents and intermediates in the organic reactions.

stability and reactions are expected). Carbon free radicals, carbenes, arenes, nitrenes (Definition with example only)		
2. Structure and Bonding 2.1 Hybridization: sp_3, sp_2 and sp w.r.t. methane, ethylene and acetylene respectively. 2.2 Bond length, Bond angle and Bond energy with factors affecting these properties w.r.t. : sp_3, sp_2 and sp hybridization 2.3 Resonance effect with respect to phenol, and nitrobenzene. 2.4 Hyperconjugation w.r.t. toluene. 2.5 Inductive effect, + I and - I . 2.6 Steric effect w.r.t. mesitoic acid	**To study** 2.1 Hybridization: sp_3, sp_2 and sp w.r.t. methane, ethylene and acetylene respectively. 2.2 Bond length, Bond angle and Bond energy with factors affecting these properties w.r.t. : sp_3, sp_2 and sp hybridization 2.3 Resonance effect with respect to phenol, and nitrobenzene. 2.4 Hyperconjugation w.r.t. toluene. 2.5 Inductive effect, + I and - I . 2.6 Steric effect w.r.t. mesitoic acid	**Students gain an understanding of :** The Hybridization involved in molecule and get knowledge of Bond length, Bond angle and Bond energy possess by molecule. Students gains the knowledge of various effects exerted by the organic compounds like Resonance effect with respect to phenol, and nitrobenzene, Hyperconjugation w.r.t. toluene, Inductive effect, + I and – I, Steric effect w.r.t. mesitoic acid
3. Alkanes and Cycloalkanes 3.1 Alkanes : Methods of formation with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acid. 3.2 Mechanism of free radical halogenation of alkanes. 3.3 Cycloalkanes - Nomenclature methods of formation (a) Internal Wurtz reaction (b) Distillation of calcium or barium salt of dicarboxylic acid. 3.4 Chemical properties of cyclopropane (i) Free radical substitution of chlorine in presence of light. (ii) Action of HBr and conc. H_2SO_4 iii) Catalytic reduction by	**To study** 3.1 Alkanes : Methods of formation with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acid. 3.2 Mechanism of free radical halogenation of alkanes. 3.3 Cycloalkanes - Nomenclature methods of formation (a) Internal Wurtz reaction (b) Distillation of calcium or barium salt of dicarboxylic acid. 3.4 Chemical properties of cyclopropane (i) Free radical substitution of chlorine in presence of light. (ii) Action of HBr and conc. H_2SO_4 iii) Catalytic reduction by H_2/Ni	**Students gain an understanding of :** 3.1 Alkanes : Methods of formation with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acid. 3.2 Mechanism of free radical halogenation of alkanes. 3.3 Cycloalkanes - Nomenclature methods of formation (a) Internal Wurtz reaction (b) Distillation of calcium or barium salt of dicarboxylic acid. 3.4 Chemical properties

		of cyclopropane (i) Free radical substitution of chlorine in presence of light. (ii) Action of HBr and conc. H_2SO_4 iii) Catalytic reduction by H_2/Ni
H_2/Ni		
4. Alkenes, Dienes and Alkynes (Contact hrs: 09) Nomenclature of alkenes. Methods of formation of alkenes with mechanism i) By dehydration of lower alcohols. ii) By dehydrohalogenation of lower alkyl halides. Chemical reactions of alkenes - Hydrogenation, Electrophilic and free radical additions, Hydroboration, Oxidation, Epoxidation, Ozonolysis, Hydration, Hydroxylation, Oxidation with $KMnO_4$, Polymerisation of alkenes - ethylene and propylene Nomenclature and classification of dienes. Isolated, Conjugated and cumulated dienes. Butadiene-Methods of formation,polymerisation, 1:2 and 1:4additions and Diels-Alder reaction. Alkynes - Nomenclature, Acidity of alkynes. Electrophilic and Nucleophilic addition reactions, Hydroboration, oxidation.	To study Nomenclature of alkenes. Methods of formation of alkenes with mechanism i) By dehydration of lower alcohols. ii) By dehydrohalogenation of lower alkyl halides. Chemical reactions of alkenes - Hydrogenation, Electrophilic and free radical additions, Hydroboration, Oxidation, Epoxidation, Ozonolysis, Hydration, Hydroxylation, Oxidation with $KMnO_4$, Polymerisation of alkenes - ethylene and propylene Nomenclature and classification of dienes. Isolated, Conjugated and cumulated dienes. Butadiene-Methods of formation,polymerisation, 1:2 and 1:4additions and Diels-Alder reaction. Alkynes - Nomenclature, Acidity of alkynes. Electrophilic and Nucleophilic addition reactions, Hydroboration, oxidation.	**Students gain an understanding of :** Nomenclature, methods of preparations, chemical reactions of Alkenes, Dienes and Alkynes.

5. Stereochemistry of organic compounds	To study	Students gain an understanding of :
Types of stereo-isomerism - Optical isomerism, Geometrical isomerism and Conformational isomerism. Chiral center [Explanation with lactic acid] Elements of symmetry Optical isomerism in lactic acid, tartaric acid and 2,3 - dihydroxybutanic acid Enantiomers and diastereoisomers. Racemic modification. Geometrical isomerism-cause of geometrical isomerism. Geometrical isomerism w.r.t. C = C Geometrical isomerism in maleic acid and fumaric acid.	Types of stereo-isomerism - Optical isomerism, Geometrical isomerism and Conformational isomerism. Chiral center [Explanation with lactic acid] Elements of symmetry Optical isomerism in lactic acid, tartaric acid and 2,3 - dihydroxybutanic acid Enantiomers and diastereoisomers. Racemic modification. Geometrical isomerism-cause of geometrical isomerism. Geometrical isomerism w.r.t. C = C Geometrical isomerism in maleic acid and fumaric acid.	Types of stereoisomerism, their examples, Enantiomers and diastereoisomers. Racemic modification. Geometrical isomerism-cause of geometrical isomerism. Geometrical isomerism w.r.t. C = C Geometrical isomerism in maleic acid and fumaric acid.
6. Aromaticity and Benzene	To study	Students gain an understanding of :
Meaning of the terms - Aromatic, non-aromatic, antiaromatic and psuedoaromatic compounds. a) Kekule structure of benzene b) Resonance structures of benzene. c) Molecular orbital picture of benzene. d) Representation of benzene ring. 6.3 Modern theory of aromaticity. Fundamental Concepts - delocalisation of electrons, coplanarity and Huckel's $(4n + 2)$ π rule. Applications of Huckel's rule to napthalene,	Meaning of the terms - Aromatic, non-aromatic, antiaromatic and psuedoaromatic compounds. a) Kekule structure of benzene b) Resonance structures of benzene. c) Molecular orbital picture of benzene. d) Representation of benzene ring. Modern theory of aromaticity. Fundamental Concepts - delocalisation of electrons, coplanarity and Huckel's $(4n + 2)$ π rule. Applications of Huckel's rule to napthalene, pyrrole and pyridine. Mechanism of electrophilic aromatic substitution in benzene w.r.t. nitration, sulphonation,	Meaning of different terms, Resonance and Molecular orbital picture of benzene. Fundamental Concepts - delocalisation of electrons, Mechanism of electrophilic aromatic substitution in benzene w.r.t. nitration, sulphonation, halogenation and Friedel - Craft's reaction- alkylation and acylation

pyrrole and pyridine. 6.4 Mechanism of electrophilic aromatic substitution in benzene w.r.t. nitration, sulphonation, halogenation and Friedel - Craft's reaction- alkylation and acylation	halogenation and Friedel - Craft's reaction- alkylation and acylation	

Dilare.

Principal

Hemuji Chandele College
Shelgaon(R) Tal-Barshi Dist-Solapur

Pachute

Head of the Department
Chemistry

B.Sc. I

NAME OF SUBJECT: Chemistry

SEM : II

COURSE NUMBER (PAPER NUMBER): P-IV

TITLE OF COURSE (NAME OF PAPER): Analytical Chemistry

COURSE CONTENT	OBJECTIVES	OUTCOME
1. Physical properties of liquids Introduction, additive and constitutive properties 1.2 **Viscosity:** coefficient of viscosity, determination of viscosity by Ostwald's Viscometer **Surface tension:** Determination of surface tension by Drop –Weight method **Parachor:** Macleod equation and its modification by Sugden, applications of parachor in the determination of molecular structures as benzene and NO2 group **Dipole moment:** electrical polarization of molecules Use of dipole moment in the study of molecular structure **Refractometery:** Refractive index, Snell's law Specific and molecular refractivity, Abbe's refractometer: Principle-critical angle phenomenon-construction, working and advantages Molecular refractivity and chemical constitution	To understand the properties like Introduction, additive and constitutive properties Viscosity, coefficient of viscosity, determination of viscosity by Ostwald's Viscometer Surface tension:- Determination of surface tension by Drop –Weight method Parachor:-Macleod equation and its modification by Sugden, applications of parachor in the determination of molecular structures as benzene and NO2 group Dipole moment, electrical polarization of molecules Use of dipole moment in the study of molecular structure Refractive index, Snell's law	**Student understands the concepts:** Introduction, additive and constitutive properties Viscosity, coefficient of viscosity, determination of viscosity by Ostwald's Viscometer Surface tension:- Determination of surface tension by Drop –Weight method Parachor:-Macleod equation and its modification by Sugden, applications of parachor in the determination of molecular structures as benzene and NO2 group Dipole moment, electrical polarization of molecules Use of dipole moment in the study of molecular

		structure 1.7 Refractive index, Snell's law

2. Environmental Chemistry: Air pollution
   Introduction: Meaning of terms: Environment, Pollution, Pollutant, Threshold Limit Value (TLV), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD)
   Types of Pollution (Only Introduction): Air pollution, Water pollution, Sound pollution, Soil pollution, Automobile pollution and nuclear pollution.
   Air Pollution: Classification of Air pollutants, Oxides of carbon, Sulphur and Nitrogen as air pollutants with respect to source and health hazards.
	To study
	
	  Introduction: Meaning of terms: Environment, Pollution, Pollutant, Threshold Limit Value (TLV), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD)
	  Types of Pollution (Only Introduction): Air pollution, Water pollution, Sound pollution, Soil pollution, Automobile pollution and nuclear pollution.
	  Air Pollution: Classification of Air pollutants, Oxides of carbon, Sulphur and Nitrogen as air pollutants with respect to source and health hazards.
		Students gain an understanding of :
		Introduction: Meaning of terms: Environment, Pollution, Pollutant, Threshold Limit Value (TLV), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD)
		  Types of Pollution (Only Introduction): Air pollution, Water pollution, Sound pollution, Soil pollution, Automobile pollution and nuclear pollution.
		  Air Pollution: Classification of Air pollutants, Oxides of carbon, Sulphur and Nitrogen as air pollutants with respect to source and health hazards.

3. Environmental Chemistry: Water pollution
   Introduction: Resources of water, Types of water Pollutants, water Pollution and its sources (Brief Account)
   Treatment of water:
A) Potable Water: Parameters of potability of water
Step I: Removal of suspended matter :
 	
a) Prolonged storage b) Screening
c) Sedimentation d) Coagulation
e) Filtration
Step II: Removal of germs and
	To Study
	   Introduction: Resources of water, Types of water Pollutants, water Pollution and its sources (Brief Account)
	   Treatment of water:
	A) Potable Water: Parameters of potability of water
	Step I: Removal of suspended matter :
	a) Prolonged storage b) Screening
	c) Sedimentation d) Coagulation
	e) Filtration
	Step II: Removal of germs and bacteria- Physical and Chemical
		Students gain an understanding of :
		Step I: Removal of suspended matter
		a) Prolonged storage b) Screening
		c) Sedimentation d) Coagulation
		e) Filtration
		Step II: Removal of germs and bacteria- Physical and Chemical method.
		Physical Methods : a) Boiling b) Exposure to UV or Sunlight

bacteria- Physical and Chemical method. Physical Methods : a) Boiling b) Exposure to UV or Sunlight c) Distillation. Chemical Method : a) Chlorination b) Fluorination c) Ozonisation d) Aeration e) Use of $KMnO_4$ B) Industrial Water: Mention names of the methods only, Ion exchange method in detail. C) Municipal Sewage: Meaning of Sewage; mention the names of methods; activated sludge process in detail.	method. Physical Methods : a) Boiling b) Exposure to UV or Sunlight c) Distillation. Chemical Method : a) Chlorination b) Fluorination c) Ozonisation d) Aeration e) Use of $KMnO_4$ B) Industrial Water: Mention names of the methods only, Ion exchange method in detail. C) Municipal Sewage: Meaning of Sewage; mention the names of methods; activated sludge process in detail.	c) Distillation. Chemical Method : a) Chlorination b) Fluorination c) Ozonisation d) Aeration e) Use of $KMnO_4$ B) Industrial Water: Mention names of the methods only, Ion exchange method in detail. C) Municipal Sewage: Meaning of Sewage; mention the names of methods; activated sludge process in detail.

4. Qualitative and Quantitative elemental analysis
    Qualitative analysis of Carbon, Hydrogen, Nitrogen & Sulphur
    Quantitative analysis of -
i) Carbon and hydrogen by Combustion method
ii) Nitrogen by Kjeldahl's method
iii) Halogen and Sulphur by Carius method.
    Determination of molecular weight of an acid by titration method.
    Empirical formula and molecular formula determination. (Numerical Problems Expected)
	To study
	 Qualitative analysis of Carbon, Hydrogen, Nitrogen & Sulphur
	Quantitative analysis of -
	i) Carbon and hydrogen by Combustion method
	ii) Nitrogen by Kjeldahl's method
	iii) Halogen and Sulphur by Carius method.
	 Determination of molecular weight of an acid by titration method.
	 Empirical formula and molecular formula determination. (Numerical Problems Expected)
		Students gain an understanding of :
		Qualitative analysis of Carbon, Hydrogen, Nitrogen & Sulphur
		Quantitative analysis of -
		i) Carbon and hydrogen by Combustion method
		ii) Nitrogen by Kjeldahl's method
		iii) Halogen and Sulphur by Carius method.
		Determination of molecular weight of an acid by titration method
		Empirical formula and molecular formula determination. (Numerical Problems Expected)

5. Petroleum and petrochemicals (Contact hrs: 07)
    Constituents and refining of petroleum, cracking, knocking, octane, hydro-forming
    Synthesis and Industrial applications of following petrochemicals:
a) Ethylene oxide
b) Adipic acid
c) Styrene
	To Study
	 Constituents and refining of petroleum, cracking, knocking, octane, hydro-forming
	 Synthesis and Industrial applications of following petrochemicals:
	a) Ethylene oxide
	b) Adipic acid
	c) Styrene
	d) 2-Phenyl ethanol
	e) Paracetamol
		Students gain an understanding of :
		Constituents and refining of petroleum, cracking, knocking, octane, hydro-forming
		 Synthesis and Industrial applications of following petrochemicals:
		a) Ethylene oxide
		b) Adipic acid

d) 2-Phenyl ethanol e) Paracetamol		c) Styrene d) 2-Phenyl ethanol e) Paracetamol

Signature of HOD

Head of the Department
Chemistry

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Hemuji Chandele College
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Tuljabhavani Mahila Mandal's

Hemuji Chandele College, Shelgaon (R),

Tal. Barshi, Dist. Solapur (Maharashtra) 413222

Name of Department: Chemistry

B.Sc. II

NAME OF SUBJECT: Organic Chemistry

SEM III

COURSE NUMBER (PAPER NUMBER): P-V

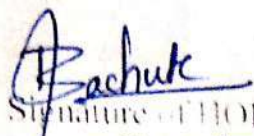**TITLE OF COURSE (NAME OF PAPER): Organic Chemistry**

COURSE CONTENT	OBJECTIVES	OUTCOME
o **Spectroscopic Methods Ultra-Violet (UV) absorption :** Introduction to Spectroscopy, Beer – Lambert law (mathematical derivation not expected), Types of electronic transitions, Terms used in UV spectroscopy: Chromophore, Auxochrome, BathocromicHypsochromic, Hypochromic and Hyperchromic shifts, Effect of conjugation on position of UV and visible bands. Calculation of _max by Woodward-Fieser rules for conjugated dienes and enones. Applications of UV spectroscopy – Determination of structure and stereochemistry (cis and trans) spectral problems based on UV.	**To study** Introduction to Spectroscopy, Beer – Lambert law (mathematical derivation not expected), Types of electronic transitions, Terms used in UV spectroscopy: Chromophore, Auxochrome, BathocromicHypsochromic, Hypochromic and Hyperchromic shifts, Effect of conjugation on position of UV and visible bands. Calculation of _max by Woodward-Fieser rules for conjugated dienes and enones. Applications of UV spectroscopy – Determination of structure and stereochemistry (cis and	**Student understands the concepts:** Beer – Lambert law, Types of electronictransitions, Terms used in UV spectroscopy: Chromophore, Auxochrome, BathocromicHypsochromic, Hypochromic and Hyperchromic shifts, Effect of conjugation on position of UV and visible bands. **Students are able to solve** the problems related UV spectroscopy.
2. Stereochemistry (8) Geometrical isomerism : Introduction,	**To study the** **2.1. Geometrical**	**Students gain an understanding of :** Types of stereoisomerism, their examples, Enantiomers and

Geometrical isomerism in aldoximes and ketoximes, configuration of ketoximes-Beckmann transformation (Mechanism & Proof are not expected) configuration of aldoximes. **2.2. Conformational Isomerism :** Introduction, conformation of ethane and n-butane and their representation by using Saw-Horse, Fischer (dotted Wedge line) and Newmann's projection formulae. **2.3.** Conformational analysis of ethane and n-butane with the help of energy profile diagrams. **2.4.** Nomenclature – D & L, R & S, E & Z systems	**isomerism :** Introduction, Geometrical isomerism in aldoximes and ketoximes, configuration of ketoximes-Beckmann transformation (Mechanism & Proof are not expected) configuration of aldoximes. **2.2. Conformational Isomerism :** Introduction, conformation of ethane and n-butane and their representation by using Saw-Horse, Fischer (dotted Wedge line) and Newmann's projection formulae. **2.3.** Conformational analysis of ethane and n-butane with the help of energy profile diagrams. **2.4.** Nomenclature – D & L, R & S, E & Z systems	diastereoisomers. Racemic modification. Geometrical isomerism-cause of geometrical isomerism. Geometrical isomerism w.r.t. $C = C$ Geometrical isomerism in maleic acid and fumaric acid.
3. Alcohols and Phenols (8) **3.1. Alcohols :** **Introduction** i. Dihydric alcohols : Nomenclature, Methods of formation of ethylene glycol from ethylene, ethylene dibromide and ethylene oxide, physical properties & chemical reactions of ethylene glycol – acidic nature, reaction with hydrogen halide, oxidation – lead acetate, HIO_4 and nitric acid, Uses of ethylene glycol. Pinacol formation, Pinacol-Pinacolone rearrangement and its mechanism. ii. Trihydric alcohols : Nomenclature, Methods of formation of glycerol – from fats and oils physical properties. Chemical reactions of glycerol –	To study the i. Dihydric alcohols : Nomenclature, Methods of formation of ethylene glycol from ethylene, ethylene dibromide and ethylene oxide, physical properties & chemical reactions of ethylene glycol – acidic nature, reaction with hydrogen halide, oxidation – lead acetate, HIO_4 and nitric acid, Uses of ethylene glycol. Pinacol formation, Pinacol-Pinacolone rearrangement and its mechanism. ii. Trihydric alcohols : Nomenclature, Methods of formation of glycerol – from fats and oils physical properties. Chemical reactions of glycerol – reaction with electropositive metals,	**Students gain an understanding of :** To study the acyclic aliphatic and aromatic alcohols Also the study Mono, Di, Tri- hydric alcohols Synthesis of phenols and alcohols Applications of aliphatic and aromatic alcohols

reaction with electropositive metals, reaction with hydrogen halideHCl and HI Reaction with conc. nitric acid in presence of conc. sulphuric acid. Reactions with potassium hydrogen sulphate, esterification, oxidation. Uses of glycerol. **3.2. Phenols :** Introduction, Reactions of phenol (carbolic acid) : i. Acylation and Fries rearrangement ii. Ether formation and claisen rearrangement iii. Gattermann Synthesis iv. Carboxylation – Kolbe's reaction v. Reimer – Tiemann reaction and its mechanism.	reaction with hydrogen halideHCl and HI Reaction with conc. nitric acid in presence of conc. sulphuric acid. Reactions with potassium hydrogen sulphate, esterification, oxidation. Uses of glycerol. **3.2. Phenols :** Introduction, Reactions of phenol (carbolic acid) : i. Acylation and Fries rearrangement ii. Ether formation and claisen rearrangement iii. Gattermann Synthesis iv. Carboxylation – Kolbe's reaction v. Reimer – Tiemann reaction and its mechanism.	
4. Aldehydes and Ketones Introduction, Nomenclature, structure and reactivity of the carboxyl group. Mechanism of nucleophilic additions to carbonyl group. Study of following reactions with mechanism 1) Aldol condensation (base catalysed), 2) Perkin reaction, 3) Cannizzaro's reaction, 4) Knoevenagel reaction 5) benzoin condensation.	**To study** Nomenclature, structure and reactivity of the carboxyl group. Mechanism of nucleophilic additions to carbonyl group. Study of following reactions with mechanism 1) Aldol condensation (base catalysed), 2) Perkin reaction, 3) Cannizzaro's reaction, 4) Knoevenagel reaction 5) benzoin condensation.	**Students gain an understanding of :** Nomenclature, structure and reactivity of the carboxyl group. Mechanism of nucleophilic additions to carbonyl group. Study of following reactions with mechanism 1) Aldol condensation (base catalysed), 2) Perkin reaction, 3) Cannizzaro's reaction, 4) Knoevenagel reaction 5) benzoin condensation`
5. Ethers and Epoxides **Ethers :** Introduction, Nomenclature, Methods of formation of anisole by Williamson's synthesis and from diazomethane, chemical	**To study** **5.1. Ethers :** Introduction, Nomenclature, Methods of formation of anisole by Williamson's synthesis and from diazomethane, chemical	**Students gain an understanding of :** **Ethers :** Nomenclature, Methods of formation of anisole by Williamson's synthesis and from diazomethane, chemical reactions of anisole with HI, Gravimetric estimation of $-OCH_3$ group by Ziesel's

reactions of anisole with HI, Gravimetric estimation of –OCH$_3$ group by Ziesel's method (Related problems are expected based on % of –OCH$_3$ and number of – OCH$_3$ groups). **5.2. Epoxides** :Introduction, Nomenclature, commercial method of preparation of ethylene oxide. Acid and base catalysed ring opening of ethylene oxide, reactions of Grignard and organolithium reagents with ethylene oxide.	reactions of anisole with HI, Gravimetric estimation of –OCH$_3$ group by Ziesel's method (Related problems are expected based on % of –OCH$_3$ and number of – OCH$_3$ groups). **5.2. Epoxides** :Introduction, Nomenclature, commercial method of preparation of ethylene oxide. Acid and base catalysed ring opening of ethylene oxide, reactions of Grignard and organolithium reagents with ethylene oxide.	method (Related problems are expected based on % of –OCH$_3$ and number of – OCH$_3$ groups). **Epoxides :**Introduction, Nomenclature, commercial method of preparation of ethylene oxide. Acid and base catalysed ring opening of ethylene oxide, reactions of Grignard and organolithium reagents with ethylene oxide.

6. Carboxylic acids (7)
    Monocarboxylic acids : Introduction. Methods of formation of Halo acids, di- and trichloroacetic acid by HVZ reaction, substitution reactions of monochloroacetic acid by nucleophiles CN--, OH--, I--, and NH$_3$.
    Hydroxyacids : Malic acid and citric acid, Methods of formation of malic acid from acid and moist Ag$_2$O.
Reactions of malic acid – action of heat, oxidation reaction and reaction with HI, uses of malic acid. Methods of formation of citric acid from glycerol. Reactions of citric acid.
Acetylation with acetic anhydride reduction by HI, Action of heat at 422$_0$K. Uses of citric acid.
    Unsaturated acids : Methods of formation of acrylic acid from acrolein and by dehydration of _- hydroxyl
	To study
	    Monocarboxylic acids : Introduction. Methods of formation of Halo acids, di- and trichloroacetic acid by HVZ reaction, substitution reactions of monochloroacetic acid by nucleophiles CN--, OH--, I--, and NH$_3$.
	    Hydroxyacids : Malic acid and citric acid, Methods of formation of malic acid from acid and moist Ag$_2$O.
	Reactions of malic acid – action of heat, oxidation reaction and reaction with HI, uses of malic acid. Methods of formation of citric acid from glycerol. Reactions of citric acid.
	Acetylation with acetic anhydride reduction by HI, Action of heat at 422$_0$K. Uses of citric acid.
	    Unsaturated acids : Methods of formation of acrylic acid from acrolein and by dehydration of _- hydroxyl
		Students gain an understanding of :
		Monocarboxylic acids : Introduction. Methods of formation of Halo acids, di- and trichloroacetic acid by HVZ reaction, substitution reactions of monochloroacetic acid by nucleophiles CN--, OH--, I--, and NH$_3$.
		Hydroxyacids : Malic acid and citric acid, Methods of formation of malic acid from acid and moist Ag$_2$O.
		Reactions of malic acid – action of heat, oxidation reaction and reaction with HI, uses of malic acid. Methods of formation of citric acid from glycerol. Reactions of citric acid.
		Acetylation with acetic anhydride reduction by HI, Action of heat at 422$_0$K. Uses of citric acid.
		Unsaturated acids : Methods of formation of acrylic acid from acrolein and by dehydration of _-hydroxyl propionic acid. Reactions of acrylic acid – Addition of H$_2$O reduction by Na / C$_2$H$_5$OH. Uses of acrylic acid.
		Methods of formation of cinnamic acid from benzaldehyde using diethyl malonate and by using acetic anhydride and sodium acetate. Reactions of cinnamic acid – bromination, oxidation. Uses of cinnamic acid.
		Dicarboxylic acids : Succinic and phthalic acids. Methods of formation of succinic acid

propionic acid. Reactions of acrylic acid – Addition of H_2O reduction by Na / C_2H_5OH. Uses of acrylic acid. Methods of formation of cinnamic acid from benzaldehyde using diethyl malonate and by using acetic anhydride and sodium acetate. Reactions of cinnamic acid – bromination, oxidation. Uses of cinnamic acid. **6.4.** Dicarboxylic acids : Succinic and phthalic acids. Methods of formation of succinic acid from ethylene bromide, maleic acid. Reactions of succinic acid – action of heat, action of $NaHCO_3$, C_2H_5OH in presence of acid. Uses of succinic acid. Methods of formation of phthalic acid from o-xylene and naphthalene Reactions of phthalic acid – action of heat, reaction with sodalime, NH_3. Uses of phthalic acid.	propionic acid. Reactions of acrylic acid – Addition of H_2O reduction by Na / C_2H_5OH. Uses of acrylic acid. Methods of formation of cinnamic acid from benzaldehyde using diethyl malonate and by using acetic anhydride and sodium acetate. Reactions of cinnamic acid – bromination, oxidation. Uses of cinnamic acid. **6.4.** Dicarboxylic acids : Succinic and phthalic acids. Methods of formation of succinic acid from ethylene bromide, maleic acid. Reactions of succinic acid – action of heat, action of $NaHCO_3$, C_2H_5OH in presence of acid. Uses of succinic acid. Methods of formation of phthalic acid from o-xylene and naphthalene Reactions of phthalic acid – action of heat, reaction with sodalime, NH_3. Uses of phthalic acid.	from ethylene bromide, maleic acid. Reactions of succinic acid – action of heat, action of $NaHCO_3$, C_2H_5OH in presence of acid. Uses of succinic acid. Methods of formation of phthalic acid from o-xylene and naphthalene Reactions of phthalic acid – action of heat, reaction with sodalime, NH_3. Uses of phthalic acid.
7. Diazonium Salts (4) 7.1 Diazoniumsalts : Introduction, benzene diazonium chloride – preaparation, chemical properties. i. Formation of iodo benzene ii. Sandmeyer's reaction iii. Formation of benzene iv. Formation of phenylhydrazine v. Azo coupling – synthesis of methyl orange and congo red.	**To study** 7.1 Diazoniumsalts : Introduction, benzene diazonium chloride – preaparation, chemical properties. i. Formation of iodo benzene ii. Sandmeyer's reaction iii. Formation of benzene iv. Formation of phenylhydrazine v. Azo coupling – synthesis of methyl orange and congo red.	**Student understands the concepts** 7.1 Diazoniumsalts : Introduction, benzene diazonium chloride – preaparation, chemical properties. i. Formation of iodo benzene ii. Sandmeyer's reaction iii. Formation of benzene iv. Formation of phenylhydrazine v. Azo coupling – synthesis of methyl orange and congo red.

B.A. / B.Sc. / M.A. / M.Sc.	B.Sc. II	
NAME OF SUBJECT	: Inorganic Chemistry	
SEM I / II / III / IV / V / VI	: Sem. III	
COURSE NUMBER (PAPER NUMBER)	: P -VI	
TITLE OF COURSE (NAME OF PAPER)	: Inorganic Chemistry	

COURSE CONTENT	OBJECTIVES	OUTCOME
1. Co-ordination Chemistry : 1.1 Definition and formation of co-ordinate covalent bond in BF_3 NH_3 and in $[NH_4]^+$. 1.2 Distinction between double salt and complex salt, 1.3 Werner's theory : A. Postulates of theory, B. Applications of theory: Theory applied to cobalt amine viz: a].$CoCl_3.6NH_3$ b] $CoCl_3.5NH_3$, c] $CoCl_3.4NH_3$, d] $CoCl_3.3NH_3$ C. Limitations 1.4 Description of terms –a] ligand, b]co-ordination number, c] co-ordination sphere, d]effective atomic number, e] Geometrical isomerism and optical isomerism in co-ordination compounds for $CN = 4$ and $CN = 6$. 1.5 IUPAC nomenclature of co-ordination compounds, 1.6 Valence bond theory of transition metal complexes: A .Introduction B. Postulates of VBT/ basic concepts of VBT C. Role of transition metal in the formation of complex D. Stepwise process of formation of	Students should get knowledge about: 1) Coordinate bond and the mechanism of formation. 2) Werner's and VBT approach for the bonding and characters of coordinate bond. 3) Isomerism and IUPAC nomenclature of co-ordination compounds.	Student have understood about structure of coordination compounds along with their Isomerism and IUPAC nomenclature

complex : Salient features. E. Applications: High spin and low spin complexes w.r.t. CN = 4 and CN = 6. F. Limitations of Valence bond theory.		

2. Chelation
    A brief introduction w.r.t. ligand, chelating agent, chelation and metal chelate.
    Structural requirements of chelate formation.
    Difference between metal chelate and metal complex.
    Classification of chelating agents (with specific illustrations of bidentate chelating agent).
    Applications of chelation w.r.t. chelating agents : EDTA and DMG.
	Students should get knowledge about application of coordination chemistry as a chelating agents and metal chelate.	Students have understood about difference between metal complex and metal chelate. Also they understood the applications of chelating agents in our life.

3. Acids and Bases
    Lewis Concept : A.Definition, B.classification,C. merits and D.demerits.
    Hard and soft acids and bases (HSAB) :
A. Classification of acids and bases as hard and soft,
B. Pearson's HSAB concept,
C. Acid-Base strength and hardness-softness,
D. Applications and limitations of HSAB principle.
	1. To develop the thinking of students for acid base concept.
	2. To understand various concepts of acids and bases.
	3. To help student to classify Hard and soft acids and bases
		1. Students are able to distinguish between various examples.
		2. Students are able to apply knowledge in various content.

4. Study of d-block elements
    Introduction,
    Position of d-block elements in periodic table,
    Names& electronic configuration of 1st, 2nd & 3rd three transition series.
    General Characteristics of 3 d-block elements w.r.t. –
a) oxidation state b) colour c) Magenetic behavior (spin only formula)
	1. Enable students to distinguish between properties s-block, p-block and d-block element
	2. To help the students to understand properties of d-block element
	3. To help the students to understand electronic configuration, name symbol atomic number of 1st ,2nd,3rd transition series elements
		1. Students are able to distinguish between properties of s-block, p-block and d- block element
		2. Students are able to give properties of d-block element
		3. Students are able to give electronic configuration, atomic number , symbol and name of the three transition series element

COURSE CONTENT	OBJECTIVES	
d) catalytic properties and e) tendency to form complexes. 4.5. Comparison of 1st transition series with 2nd & 3rd transition series w.r.t. – a) electronic configuration b) reactivity c) stability of oxidation state d) magnetic behavior and e) stability of complexes (Brief account only)	4. To help the students to understand various properties of 3-d transition series element 5. To help the students to compare properties of three transition series.	4. Students are able to understand the characteristics of various properties of 3-d block element and students can apply those characters in various concept related to 3-d series elements such as co-ordination chemistry; chelation; acid base concept also in research as studies in metal complexes.

Golare.
Principal
Hemuji Chandele College
Shelgaon(R) Ta-barshi Dist-Solapur

Signature of HOD
Head of the Department
Chemistry

B.Sc. II

NAME OF SUBJECT: Physical Chemistry

SEM   IV

COURSE NUMBER (PAPER NUMBER) P-VII

TITLE OF COURSE (NAME OF PAPER): Physical Chemistry

COURSE CONTENT	OBJECTIVES	
Electrochemistry 1.1. Introduction, conduction of electricity, Types of conductors :	To study 1.1. conduction of electricity, Types of conductors : electronic and electrolytic.	**Students gain** 1.1. Conductio conductors : e

electronic and electrolytic. Explanation of terms : Conductance, Specific resistance, specific conductance, Equivalent conductance, Molecular conductance. Variation of specific and equivalent conductance with concentration, Equivalent conductance at infinite dilution. (Mention Onsager equation, $bcv = -\infty\lambda$. λ from graph) Migration of ions, Hittorf's rule, Transport number, Determination of transport number by moving boundary method, factors influencing transport number: Nature of electrolyte, concentration, temperature, complex formation and Degree of hydration. Kohlrausch law, Applications of Kohlrausch law : i. Determination of relationship between ionic conductance, ionic mobility and transport number. ii. Determination of equivalent conductance at infinite dilution of weak electrolytes. iii. Determination of degree of dissociation of weak electrolyte. iv. Determination of ionic product of water. v. Determination of solubility of sparingly soluble salts. 1.6. Numerical problems.	Explanation of terms : Conductance, Specific resistance, specific conductance, Equivalent conductance, Molecular conductance. Variation of specific and equivalent conductance with concentration, Equivalent conductance at infinite dilution. (Mention Onsager equation, $bcv = -\infty\lambda$. λ from graph) Migration of ions, Hittorf's rule, Transport number, Determination of transport number by moving boundary method, factors influencing transport number: Nature of electrolyte, concentration, temperature, complex formation and Degree of hydration. Kohlrausch law, Applications of Kohlrausch law : i. Determination of relationship between ionic conductance, ionic mobility and transport number. ii. Determination of equivalent conductance at infinite dilution of weak electrolytes. iii. Determination of degree of dissociation of weak electrolyte. iv. Determination of ionic product of water. v. Determination of solubility of sparingly soluble salts. **To solve** 1.6. Numerical problems.	Explanatio resistance, spe conductance, Molecular con Variation o conductance v conductance at dilution. (Men λ from graph) Migration o number, Deter moving bound method, factor Nature of elect complex formation and Koh[ ]isch law : i. Determinatio conductance, i ii. Determinatio infinite dilutior iii. Determinati weak electrolyt iv. Determinati v. Determinatio salts. Student becom problems based
2. Thermodynamics Introduction, concept of entropy, Entropy as a state function: Definition, mathematical expression, unit, physical significance of entropy. Entropy changes for reversible and irreversible processes in isolated systems. Entropy changes for an ideal gas as a function of V and T and as a function of P and T. Entropy change in mixing of gases. Entropy change in physical transformations :	**To study** concept of entropy, Entropy as a state function: Definition, mathematical expression, unit, physical significance of entropy. Entropy changes for reversible and irreversible processes in isolated systems. Entropy changes for an ideal gas as a function of V and T and as a function of P and T. Entropy change in mixing of gases. Entropy change in physical transformations :	**Students gain** concept of function: Definitio unit, physical si Entropy cha irreversible pro Entropy cha of V and T and P and T. Entropy cha Entropy cha i. Fusion of a s ii. Vaporizatior

iii. Transition f
2.6. Third law
entropy and Ev
absolute entrop
Determination
reactions.
Students gains
problems.

i. Fusion of a solid.
ii. Vaporization of a liquid.
iii. Transition from one crystalline form to another.
  Third law of thermodynamics, Absolute entropy and Evaluation of absolute entropy, use of absolute entropies:
Determination of entropy changes in chemical reactions.
  Numerical problems.
	i. Fusion of a solid.
	ii. Vaporization of a liquid.
	iii. Transition from one crystalline form to another.
	  Third law of thermodynamics, Absolute entropy and Evaluation of absolute entropy, use of absolute entropies:
	Determination of entropy changes in chemical reactions.
	To solve
	  Numerical problems.	

Physical properties of liquids
  Introduction, additive and constitutive properties
  Viscosity: coefficient of viscosity, determination of viscosity by Ostwald's Viscometer
  Surface tension: Determination of surface tension by Drop –Weight method
  Parachor: Macleod equation and its modification by Sugden, applications of parachor in the
determination of molecular structures as benzene and NO2 group
  Dipole moment: electrical polarization of molecules
  Use of dipole moment in the study of molecular structure
  Refractometery: Refractive index, Snell's law
  Specific and molecular refractivity, Abbe's refractometer: Principle-critical angle phenomenon-construction, working and advantages
  Molecular refractivity and chemical constitution
	To understand basic concepts of viscosity, S.T, parachore, dipole moment refractive index, etc.	Student should a
		course.

Signature of HOD

Badhuk

Head of the Department
Chemistry

Golare.
Principal
Hemuji Chandele College
Shelgaon(R) Tal-Barshi Dist-Solapur

B.A. / B.Sc. / M.A. / M.Sc.	: B.Sc. II
NAME OF SUBJECT	: Inorganic Chemistry

SEM I / II / III / IV / V / VI	: Sem. IV
COURSE NUMBER (PAPER NUMBER)	: VIII
TITLE OF COURSE (NAME OF PAPER)	: **Analytical and Industrial Inorganic Chemistry**

COURSE CONTENT	OBJECTIVES	OUTCOME

1. Volumetric Analysis :
  Introduction, Terminology :-
Titrant; Titrand, standard solution;
Titration Indicator; Equivalence
point; End
point.Primary standard ,Secondary
standard. Strength of solution,
volumetric analysis & their types.
  Acid Base Titration
i) Introduction
ii) Theory of Acid-Base indicator :
A) Colour change Interval
B) Theories-Ostwald's theory
&Quinoid theory,
iii) Neutralization curve and choice of
indicator for following titrations :
A) Strong acid and Strong Base
B) Strong Acid and Weak Base
C) Weak Acid and Strong Base
1.3 Complexometric titration :
A) General account,
B) Types of EDTA Titrations,
C) Metallochromic Indicator w.r.t.
Eriochrome Black-T
	1. To help the students to
	understand various
	concepts of volumetric
	analysis
	2. to help the students to
	understand different types
	of volumetric analysis
	3. to help the students to
	understand various types
	of acid base reactions
		1. Students are able to
		understand various type
		of volumetric analysis
		2. Students are able to
		distinguish between
		types of titrations
		3. Students are able to
		apply knowdge in
		various fields of
		chemistry

2. Gravimetric Analysis:
  Introduction, Terminology :-
Gravimetric analysis, Saturation,
Super-saturation, Sol, Gel,
Coagulation or Flocculation,
Coagulation or Flocculation value,
Peptisation, Precipitation, Precipitate,
Precipitant, Solubility, Aging or
digestion, Ignition,
  General steps involved in
gravimetry
  Precipitation – A) Physical
nature of Precipitate: Gelatinous,
Curdy and Crystalline.
B) Conditions of Precipitation
2.4. Process of precipitation – A)
Nucleation B) Crystal growth C)
	1. To enable students to
	understand various
	concept of gravimetric
	analysis
	2. to enable students to
	understand steps in
	gravimetric analysis
	3. to help the students to
	understand various
	applications of
	gravimetric analysis in
	field of chemistry
		1. Students understood
		various concept of
		gravimetric analysis
		2. Students understood
		steps of gravimetric
		analysis
		3. Students are able to
		apply gravimetric
		analysis in various
		field of chemistry

Digestion
    Co-precipitation and Post precipitation and their difference.
    Role of Organic precipitants in gravimetric analysis,
    Study of organic precipitants viz.
A) DMG, B) Aluminon, C) 8-Hydroxyquinoline.
2.8. Advantages and disadvantages of organic precipitants.		

3. Industrial heavy Chemicals:
    Introduction
    Physicochemical Principles & manufacture of following heavy chemicals:
i) Ammonia by Haber process
ii) Sulphuric acid by contact process.
	To help the students to understand heavy chemicals such as ammonia, sulphuric acid.	Students understood the concept of manufacturing of heavy chemicals.

4. Metallurgy:
    Introduction: Terminology:-
Metallurgy, Mineral, Ore, Gangue, Flux, Slag.
    Occurrence of metals: Types of ores
    Steps involved in metallurgical processes:
A) Concentration of ores-
I. Physical methods:
a) Gravity separation method, b) Magnetic separation method, c) Froth flotation process.
II. Chemical Methods:
a) Calcination b) Roasting
B) Reduction- i) Chemical methods of reduction
ii) Electrolytic reduction method for e.g. Aluminium and copper
	Students should get knowledge about;
	The concept of Metallurgy, occurrence of metals and their separation methods.
		Students understood the existence of metallic elements and the types of their compounds in the nature. They also learn the principle and methodology of separation techniques of metals.

5. Iron and Steel: Occurrence of Iron Extraction of Iron: Blast furnace Types of Iron Steel- A) Definition B) Types of Steel C) Manufacture of Steel: a) Bessemer process b) L. D. process	Students should get knowledge about; Chemistry of iron and their compound.	Students understood the occurrence of iron, their separation from source and preparation of steel from cast iron.

D) Heat treatment on Steel		

COURSE OUTCOME

Name of Department: Chemistry

B.Sc. III
NAME OF SUBJECT: Physical Chemistry
SEM V
COURSE NUMBER (PAPER NUMBER) P-IX
TITLE OF COURSE (NAME OF PAPER): Analytical and Industrial Physical Chemistry

COURSE CONTENT	OBJECTIVES	OUTCOME
Phase Equilibri Introduction Gibbs phase rule : Phase rule equation and explanation of terms involved in the equation. 1.3 Phase diagram, true and metastable equilibria. 1.4 One component systems : (i) Water system (ii) Sulphur system with explanation for polymorphism. 1.5 Two component systems : (i) Eutectic system : (Ag - Pb system); Desilverisation of lead, (ii) Formation of compound with congruent melting point ($FeCl_3$ - H_2O)a	To understand the basic knowledge about homogeneous ,heterogeneous reactions, Gibbs' phase rule one and two components systems	Student should able to apply the phase rule to various systems and should explain.
Photochemistry. [12] 3.1 Introduction 3.2 Difference between thermal and photochemical processes. 3.3 Laws of photochemistry : Grotthus - Draper law,	To understand the basic knowledge about Difference between thermal and photochemical processes. 3.3 Laws of photochemistry : Grotthus - Draper law, Lambert law, Lambert - Beer's law (with derivation), Stark -	i)At the end of the course, the student will be able to explain basic concept of Quantum yield, Photosensitized reactions, Jablonski diagram ii)Student should understand the basic concepts and satisfied. Solve the problems.

Lambert law, Lambert - Beer's law (with derivation), Stark - Einstein law. Quantum yield, Reasons for high quantum yield (e.g. $H_2 - Cl_2$) and low quantum yield. (e.g. Decomposition of HI and HBr). Photosensitized reactions - Dissociation of H_2, Photosynthesis. Photodimerisation of anthracene. Jablonski diagram depicting various processes occurring in the excited state : Qualitative description of fluorescence and phosphorescence. Chemiluminescence. Numerical problems. *Reference Books:*	Einstein law. 3.4 Quantum yield, Reasons for high quantum yield (e.g. $H_2 - Cl_2$) and low quantum yield. 5 Photosensitized reactions - Dissociation of H_2, Photosynthesis. Photodimerisation of anthracene. Jablonski diagram depicting various processes occurring in the excited state : Qualitative description of fluorescence and phosphorescence. Chemiluminescence. Numerical problems.	

Electro chemistry	**To know the basic concept of**	**Students will**
Introduction Thermodynamics of electrode potentials, Nernst equation for electrode and cell potentials in terms of activities. Types of electrodes : Description in terms of construction, representation, half cell reaction and emf equation for, i) Metal - metal ion electrode. ii) Amalgam electrode. iii) Metal - insoluble salt electrode. iv) Gas - electrode. v) Oxidation - Reduction electrode. 2.4 i) Reversible and Irreversible cells. ii) Chemical cells without transference. iii) Concentration cells a. Electrode concentration cell I) Reversible to cation II) Reversible to anion	Introduction Thermodynamics of electrode potentials, Nernst equation for electrode and cell potentials in terms of activities. Types of electrodes : Description in terms of construction, representation, half cell reaction and emf equation for, i) Metal - metal ion electrode. ii) Amalgam electrode. iii) Metal - insoluble salt electrode. iv) Gas - electrode. v) Oxidation - Reduction electrode. 2.4 i) Reversible and Irreversible cells. ii) Chemical cells without transference. iii) Concentration cells a. Electrode concentration cell I) Reversible to cation II) Reversible to anion b. Electrolyte concentration cells without transference	basic concept Thermodyn Nernst equatic cell potentials Types of e construction, r reaction d e i) Metal - met electrode. iii) Metal - ins electrode. v) Oxidation - 2.4 i) Reversib ii) Chemical c iii) Concentrat a. Electrode co I) Reversible t II) Reversible b. Electrolyte transference

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Hemuji Chandele College

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Signature of HOD

Head of the Department

Chemistry

B.A. / B.Sc. / M.A. / M.Sc.	**: B.Sc. III**

NAME OF SUBJECT : Inorganic Chemistry SEM I

SEM I / II / III / IV / V / VI : Sem. V

COURSE NUMBER (PAPER NUMBER) : **X**

TITLE OF COURSE (NAME OF PAPER) : **Inorganic Chemistry**

COURSE CONTENT	OBJECTIVES	OUTCOME
Metal Ligand Bonding in Transition Metal Complexes : **A) Crystal Field Theory (CFT).** 1.A.1) Introduction - What is CFT? 1.A.2) Basic concept of CFT. 1.A.3) Formation of complexes with Crystal field splitting of 'd' orbitals i. Shapes of d orbitals and their electron density region ii. Formation of octahedral Complex with Crystal field splitting of 'd' orbitals, e.g. High spin and low spin octahedral complexes of Co(III): $[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$. iii. Formation of tetrahedral Complex with Crystal field splitting of 'd' orbitals, e.g. $[CoCl_4]^{2-}$ iv. Formation of square planer Complex with Crystal field splitting of 'd' orbitals e.g. $[Co(CN)_4]^{2-}$ 1.A.4. Jahn - Tellar distortion. 1.A.5. Factors affecting the Crystal - field splitting. 1.A.6. Crystal field stabilization energy (Δ): Calculation for octahedral	1. Enable students to understand various theories of metal ligand bonding in transition metal complex 2. To help the students to understand crystal field theory , concept of CFT, shapes of d-orbital, formation of complexes – octahedral complex and square planar complexes 3. To help the students to understand Molecular orbital theory , concept, formation of octahedral complex	1. Students understood nature of metal ligand bonding in metal complexes and the characteristics of coordinate compounds on the basis of CFT and MOT.

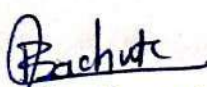|		
complexes only. 1.A.7. Applications and limitations of CFT. **B) Molecular Orbital Theory (MOT).** 1.B.1. Introduction. 1.B.2. Basic concept 1.B.3. Symmetry classes of atomic orbitals 1.B.4. Formation of octahedral complex a) Assumptions b) M.O. energy level diagram for hypothetical octahedral complex. 1.B.5. Examples: octahedral complexes with sigma bonding only such as- e.g.$[Ti(H_2O)_6]^{3+}$, $[FeF_6]^{3-}$, $[Fe(CN)_6]^{3-}$, $[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$, $[Ni(NH_3)_6]^{2+}$ 1.B.6. Applications and limitations of MOT. 1.B.7. Comparison between CFT AND MOT		
Nuclear Chemistry: 2.1. Nuclear reaction and energetics of nuclear reactions. 2.2. Classification of nuclear reactions and Types of nuclear reactions: i) Artificial transmutation. ii) Artificial radioactivity. iii) Projectile capture reaction. iv) Projectile capture - particle emission reaction. v) Nuclear fission. vi) Nuclear fusion. 2.3. Use of Uranium, Thorium and Plutonium for: a. Nuclear reactor b. Atomic Bomb. 2.4. Applications of radioisotopes as tracers. i) Chemical investigation - Esterification. ii) Structural determination - Phosphorus pentachloride. iii) Analytical Chemistry - isotopic dilution method for determination of volume of blood. iv) Age determination - Dating by C^{14}	1. To help the students to understand nuclear reactions 2. To help the students to understand difference between chemical reactions and nuclear reactions 3. To help the students to understand various types of nuclear reactions 4. To help the students to understand applications of nuclear reactions in energy production 5. To help the students to understand applications of radioactivity in various fields	1. Students understood nuclear reactions, difference between chemical and nuclear reactions 2. Students understood various types of chemical reactions and their beneficial characteristic 3. Students understood application of nuclear reactions 4. Students can apply radioactive techniques in various fields
Bioinorganic Chemistry: 3.1. Essential and trace elements in biological process. i) Essential	1. Enable students to understand requirement of essential and trace elements in	1. Students understood role of essential and trace elements in biological process 2.

elements a) Macro / major elements b) Micro/trace/minor elements ii) Non-essential elements 3.2. Metalloporphyrins with special reference to haemoglobin and myoglobin. i) Structure ofHaemoglobin(Hb) ii) Structure of Myoglobin (Mb) iii) Function of Haemoglobin (Hb) and Myoglobin (Mb) as Oxygen transport from lungs to tissues iv) Function of Haemoglobin as Carry back CO_2 to lungs v.) Co-operativity vi) Oxygen binding curve vii) Difference between Haemoglobin (Hb) and Myoglobin (Mb) 3.3. Role of alkali and alkaline earth metal ions with special reference to $Na+$, $K+$ and Ca_{2+}. i) Role of $Na+$ and $K+$ ii) Role of Ca_{2+}.	biological processes as major and minor element 2. Enable students to understand structure of hemoglobin myoglobin, function of hemoglobin, myoglobin 3. Help the students to understand role of alkali and alkaline earth metal	Students understood structure of hemoglobin and myoglobin 3. Students understood role of alkali and alkaline earth metal ions
Catalysis 4.1. Introduction 4.2. Classification of catalytic reactions : Homogeneous & Heterogeneous 4.3. Types of catalysis 4.4. Characteristics of catalytic reactions 4.5. Mechanism of catalysis : i) Intermediate compound theory ii) Adsorption theory. 4.6. Industrial Applicationsof Catalysis.	1. To help the students to understand about catalyst 2. Enable students to understand various types of catalytic reactions 3. To help the students to understand various types of catalysis 4. To help the students to understand mechanism of catalysis 5. Enable students to understand various industrial applications of catalyst	1. Students are able to understand about catalyst 2. Students are able to understand various types of catalytic reactions 3. Students are able to understand various types of mechanism of catalysis 4. Students are able to apply catalyst in various field and various branches of chemistry and other field
Fertilizers 5.1. Nutrient Functions in plant growth : Nitrogen, Phosphorous, Potassium, Calcium, Magnesium, Sulphur, Boron, Iron, Zinc, Manganese, Copper, Molybdenum, Chlorine, Role of these nutrients as : Functions, Excess supply and Deficiency. 5.2. Definition and qualities of an	1. Enable students to understand various nutrient required for plant growth 2. Enable students to understand definition, qualities of fertilizer 3. To help the students to understand manufacturing process of various fertilizer	1. Students understood various plant nutrient 2. Students understood definition, qualities of various fertilizer 3. Students can apply these manufacturing process in analytical chemistry

ideal fertilizers: 5.3. Classification or typesof fertilizers: 5.4. Manufacture of fertilizers, eg. Urea, Ammonium sulphate, Superphosphate, Triple superphosphate, Ammonium phosphate. 5.5. Mixed fertilizers, Compound or complex fertilizers. 5.6. Pollution caused by fertilizers		

Head of the Department
Chemistry

B.Sc. III

NAME OF SUBJECT: Organic Chemistry

SEM : V

COURSE NUMBER (PAPER NUMBER): P- XI

TITLE OF COURSE (NAME OF PAPER): OrganicChemistry

COURSE CONTENT	OBJECTIVES	OUTCOME
1 Spectroscopic Method. [20] **1.1. Infrared Spectroscopy :** 1.1.1 Introduction, 1.1.2 Principle of IR spectroscopy, 1.1.3 Double beam IR spectrophotometer- Schematic diagram. 1.1.4 Fundamental modes of vibration, 1.1.5 Types of vibration 1.1.6 Hooke's law, 1.1.7 factors affecting values of vibrational frequencies, 1.1.8 conditions for absorption of radiation and selection rule, 1.1.9 fundamental group regions of IR spectrum, 1.1.10 Functional group region, Finger print region, 1.1.11 characteristic absorption of various functional groups, 1.1.12 Applications of IR spectroscopy – Determination of structure, Identification offunctional groups spectral problems based on IR **1.2 NMR Spectroscopy.** 1.2.1 Introduction 1.2.2. Proton magnetic resonance (1H) spectroscopy (PMR). 1.2.3 Principles of PMR	**To study the:** 1.1.2 Principle of IR spectroscopy, 1.1.3 Double beam IR spectrophotometer- Schematic diagram. 1.1.4 Fundamental modes of vibration, 1.1.5 Types of vibration 1.1.6 Hooke's law, 1.1.7 factors affecting values of vibrational frequencies, 1.1.8 conditions for absorption of radiation and selection rule, 1.1.9 fundamental group regions of IR spectrum, 1.1.10 Functional group region, Finger print region, 1.1.11 characteristic absorption of various functional groups, 1.1.12 Applications of IR spectroscopy – Determination of structure, Identification of functional groups spectral problems based on IR **To solve** 1.6 Spectral problems based on IR. **1.2 NMR Spectroscopy** 1.2.2. Proton magnetic resonance (1H) spectroscopy (PMR). 1.2.3 Principles of PMR spectroscopy. 1.2.4 Magnetic and non-magnetic	**Students gain t** All spectroscopic factors on IR and Applications of Determination of functional groups IR **Students gain t** Theory of PMR Shielding and de Chemical shift, by delta scale and TMS as referenc Peak area (integ Spin - spin split Definition of coupli **Students are ab** Problems pertaining of simple organic PMR spectroscopicUV data to be g

spectroscopy. 1.2.4 Magnetic and non-magnetic nuclei. 1.2.5. Theory of PMR spectroscopy - spinning nuclei, magnetic moment and magnetic field, processional motion of nuclei without mathematical details, nuclear resonance. 1.2.6 NMR - Instrument. Schematic diagram. 1.2.7. Shielding and deshielding. 1.2.8. Chemical shift, measurement of chemical shift, by delta scale and tau scale. 1.2.9. TMS as reference. Advantages of TMS. 1.2.10. Peak area (integration) 1.2.11. Spin - spin splitting ($n + 1$ rule). 1.2.12. Definition of coupling constant (J value) of first order coupling. 1.2.13. PMR spectra of ethanol, ethyl bromide, acetaldehyde, 1, 1, 2 - tribromoethane, ethyl acetate, acetophenone ,benzaldehyde, propanoic acid and benzoic acid 1.2.14. Problems pertaining to the structure elucidation of simple organic compounds using PMR spectroscopic data (supporting IR and UV data to be given).	nuclei. 1.2.5. Theory of PMR spectroscopy - spinning nuclei, magnetic moment and magnetic field, processional motion of nuclei without mathematical details, nuclear resonance. 1.2.6 NMR - Instrument. Schematic diagram. 1.2.7. Shielding and deshielding. 1.2.8. Chemical shift, measurement of chemical shift, by delta scale and tau scale. 1.2.9. TMS as reference. Advantages of TMS. 1.2.10. Peak area (integration) 1.2.11. Spin - spin splitting ($n + 1$ rule). 1.2.12. Definition of coupling constant (J value) of first order coupling. 1.2.13. PMR spectra of ethanol, ethyl bromide, acetaldehyde, 1, 1, 2 tribromoethane, ethyl acetate, acetophenone ,benzaldehyde, propanoic acid and benzoic acid 1.2.14. Problems pertaining to the structure elucidation of simple organic compounds using PMR spectroscopic data (supporting IR and UV data to be given).	
1.3 Mass spectroscopy. 1.3.1 Introduction. 1.3.2 Theory of mass spectroscopy 1.3.3 Mass spectrometer - schematic diagram 1.3.4 Formation of ions by ionization 1.3.5 Types of ions with examples. 1.3.6. Applications of mass spectroscopy. i) Determination of molecular weight. ii)	To study, Introduction and Theory of mass spectroscopy, Instrumentation of Mass spectrometer, Formation of ions, Types of ions, Applications of mass spectroscopy	Student got under Mass spectroscop Instrumentation, Ion formation, Types of ions, Applications

Determination of molecular formula.		
2. Stereochemistry	•To understand the concept of stereochemistry	• Students able to
A) Introduction. B) Baeyer's strain theory. C) Theory of strainless rings. D) Conformation and stability of cyclohexane and monosubstitutedcyclohexanes – methyl cyclohexane. E) Locking of conformation in t-butyl cyclohexane. F) Stereoselective and stereospecific reactions : i) Stereochemistry of addition of halogens to alkenes:syn and anti addition. Example - Addition of bromine to 2-butene. (mechanism not expected) ii) Alkaline hydrolysis of 2-chlorobutane to 2-butanol(Example of SN_2 reaction	•How calculate the angle and stability of cyclic compounds by Baeyer theory. •Effect of large groups in cyclic compounds. •Using stereochemistry, stereoselective and stereospecific reactions and stereochemical different products formation with different examples.	various types of spati • Students know and why there is energy (more stab • Students unders compound with larg compounds. • Students underst stereoselective and what is meaning products.
3. Name reactions. Mechanism and applications of following reactions : 3.1 Stobbe condensation. 3.2 Oppenauer oxidation. 3.3 MeerweinPonndorfVerley reduction. 3.4 Reformatsky reaction. 3.5 Wagner - Meerwein Rearrangement. 3.6 Hofmann rearrangement reaction. 3.7 Wittig reaction. 3.8 Related problems.	To study, Mechanism and applications of following reactions : Stobbe condensation. Oppenauer oxidation. MeerweinPonndorfVerley reduction. Reformatsky reaction. Wagner - Meerwein Rearrangement. Hofmann rearrangement reaction. Wittig reaction. Related problems.	Students gain i Mechanism and following reacti Stobbe condensation. Oppenauer oxidation. MeerweinPonndor Reformatsky rea Wagner - Meerw Hofmann rearra Wittig reaction. Related problems.
4. Organic synthesis via Enolates 4.1 Introduction - Reactive methylene group. 4.2 Ethyl acetoacetate - synthesis by Claisencondensation, acidity of methylene hydrogen (salt formation), Keto-enol tautomerism, synthetic applications - Synthesis of	**To study** 4.1 Introduction - Reactive methylene group. 4.2 Ethyl acetoacetate - synthesis by Claisen condensation, acidity of methylene hydrogen (salt formation), Keto-enol tautomerism, synthetic applications - Synthesis of alkyl and dialkyl derivatives,	**Students gain i** Basic terms invol • Types and subtyintermediates in - To study the re Ethyl acetoacetate condensation, ac • hydrogen (salt f • Also study of cond

alkyl and dialkyl derivatives, monobasic, dibasic and α- β- unsaturated acid, heterocyclic compound. 4.3 Diethyl malonate - Synthesis, acidity of methylene hydrogen (salt formation). Synthetic applications - Synthesis of alkyl and dialkyl derivatives, monobasic , dibasic acid, α- β- unsaturated acid, α-amino acid and heterocyclic compound.	monobasic, dibasic and α- β- unsaturated acid, heterocyclic compound. 4.3 Diethyl malonate - Synthesis, acidity of methylene hydrogen (salt formation). Synthetic applications - Synthesis of alkyl and dialkyl derivatives, monobasic , dibasic acid, α- β- unsand heterocyclic compoundaturated acid, α- amino acid	organic synthesis

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Chemistry
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PRINCIPAL

B.Sc. III

NAME OF SUBJECT: Physical Chemistry

SEM V

COURSE NUMBER (PAPER NUMBER) P-XII

TITLE OF COURSE (NAME OF PAPER): Analytical and Industrial Physical Chemistry

COURSE CONTENT	OBJECTIVES	OUTCOME
Potentiometry: 1) Introduction. 2) Detail study of calomel, quinhydrone and glass electrodes and their use in determination of ph 3) Potentiometric titrations: Classical and Analytical methods for locating end points. I)Acid –Base titrations. II)Redox Titrations. III)Precipitation titrations. 4) Advantages of Potentiometric titrations 5) Basic circuit of direct reading potentiometer	Detail study of calomel, quinhydrone and glass electrodes and their use in determination of ph Potentiometric titrations: Classical and Analytical methods for locating end points. Types of potentiometric titrations Acid –Base, Redox and Precipitation titrations. Advantages of Potentiometric titrations	Student should able to know various types of electrodes as reference and indicator electrodes To study the end points of reactions by potentiometric titrations
Flame Photometry: 1) General Principles. 2) Instrumentation: Block diagram,Burners: Total consumption burner, liminor floe burner and Lundergarph burner, mirror, slits, mionchromators, filters and detectors. 3) Applications in qualitative and quntitative analysis. 4) Limitations of flame photometry	Principle Various components of flame photometry Burners: Total consumption burner, liminor floe burner and Lundergarph burner, mirror, slits, mionchromators, filters and detectors. Applications in qualitative and quntitative analysis. Limitations of flame photometry	The students can know the basic knowledge of flame photometry as analytical techniques
Electroplating 3.1 Introduction. 3.2 Electrolysis, Faraday's laws, Cathode current efficiency. 3.3 Basic principles of electroplating, cleaning of articles. 3.4 Electroplating of	To study 3.2 Electrolysis, Faraday's laws, Cathode current efficiency. 3.3 Basic principles of electroplating, cleaning of articles. 3.4 Electroplating of Nickel and	Student understands the concepts: 3.2 Electrolysis, Faraday's laws, Cathode current efficiency. 3.3 Basic principles of electroplating, cleaning of

Nickel and Chromium. 3.5 Anodising	Chromium. 3.5 Anodising	articles. 3.4 Electroplating of Nickel and Chromium. 3.5 Anodising

1. Colorimetry. 1.1 Introduction 1.2 General discussion of theory of colorimetry : Lambert law, Beer's law (Derivation not expected), Terms used in Colorimetry, Application of Beer's law, Deviation from Beer's law. 1.3 Classification of methods of 'colour' measurement or comparison, Photoelectric photometer method - single cell photo-electric colorimeter	information about functioning of Colorimeter,its use in measuring concentration of unknown solutions which improves their practical skills.	Students will learn functioning of Colorimeter,improving their skills in practicals by working with the machine in determining the concentration of unkown solutions
Conductometry: 5.1 Measurement of conductance by Wheatstone bridge, Basic circuit of D.C. Wheatstone bridge, use of alternating current, conductivity water, Different types of conductivity cells, cell constant and its determination. Experimental determination of specific, equivalent and molecular conductance's. 5.2 Conductometric acid-base titrations i. Strong acid against strong base ii. Strong acid against weak base iii. Weak acid against strong base. iv. Weak acid against weak base. 5.3 Advantages of conductometric titrations	**To study** 5.1 Measurement of conductance by Wheatstone bridge, Basic circuit of D.C. Wheatstone bridge, use of alternating current, conductivity water, Different types of conductivity cells, cell constant and its determination. Experimental determination of specific, equivalent and molecular conductance's. 5.2 Conductometric acid-base titrations i. Strong acid against strong base ii. Strong acid against weak base iii. Weak acid against strong base. iv. Weak acid against weak base. 5.3 Advantages of conductometric titrations	**Students gain an understanding of :** 5.1 Measurement of conductance by Wheatstone bridge, Basic circuit of D.C. Wheatstone bridge, use of alternating current, conductivity water, Different types of conductivity cells, cell constant and its determination. Experimental determination of specific, equivalent and molecular conductance's. 5.2 Conductometric acid-base titrations i. Strong acid against strong base ii. Strong acid against weak base iii. Weak acid against strong base. iv. Weak acid against weak base. 5.3 Advantages of

B.Sc. III
NAME OF SUBJECT: Physical Chemistry
SEM VI
COURSE NUMBER (PAPER NUMBER) : P-XIII
TITLE OF COURSE (NAME OF PAPER): Physical Chemistry

COURSE CONTENT	OBJECTIVES	
Spectroscopy 1.1 Introduction 1.2 Electromagnetic radiation. 1.3 Electromagnetic spectrum, Energy level diagram. 1.4 Rotational spectra of diatomic molecules : Rigid rotor model; moment of inertia (derivation not expected); energy levels of rigid rotor, selection rule; spectral intensity; distribution using population distribution (Maxwell - Boltzman distribution), determination of bond length; isotope effect. Interaction of radiation with rotating molecule. 1.5 Vibrational spectra of diatomic molecules : Simple Harmonic oscillator model, Vibrational energies of diatomic molecules, Determination of force constant, overtones. Interaction of radiation with vibrating molecules.	**To study the:** 1.2 Electromagnetic radiation. 1.3 Electromagnetic spectrum, Energy level diagram. 1.4 Rotational spectra of diatomic molecules : Rigid rotor model; moment of inertia (derivation not expected); energy levels of rigid rotor, selection rule; spectral intensity; distribution using population distribution (Maxwell - Boltzman distribution), determination of bond length; isotope effect. Interaction of radiation with rotating molecule. 1.5 Vibrational spectra of diatomic molecules : Simple Harmonic oscillator model, Vibrational energies of diatomic molecules, Determination of force constant, overtones. Interaction of radiation with vibrating molecules. **To solve** 1.6 Numerical problems.	**Students gain the** 1.2 Electromagneti 1.3 Electromagneti diagram. 1.4 Rotational spec Rigid rotor model; not expected); ener selection rule; spec population distribut distribution), determi isotope effect. Inter rotating molecule. 1.5 Vibrational spec Simple Harmonic osc energies of diatomic force constant, over radiation with vibra **Students are able** 1.6 Numerical problem
Solution 2.1 Introduction 2.2 Ideal solutions, Raoult's law, vapour pressure of ideal and non ideal	To understand the basic concept of Normality, Molarity, Molality, Mole fraction, 2.1 Introduction 2.2	**Students will gain** basic concept of Nor Mole fraction, Raoult' Raoult's law

solutions of miscible liquids. 2.3 Vapour pressure and boiling point diagrams of miscible liquids. Type I : Systems with intermediate total vapour pressure. (i.e. System in which B.P. increases regularly - Zeotropic) Type II : Systems with a maximum in the total vapour pressure. (i.e. System with a B.P. minimum - Azeotropic)	Ideal solutions, Raoult's law, vapour pressure of ideal and non ideal solutions of miscible liquids. 2.3 Vapour pressure and boiling point diagrams of miscible liquids. Type I : Systems with intermediate total vapour pressure. (i.e. System in which B.P. increases regularly - Zeotropic) Type II : Systems with a maximum in the total vapour pressure.	2.1 Introduction 2.2 Ideal solutions, of ideal and non ide liquids. 2.3 Vapour pressure miscible liquids. Type I : Systems wit pressure. (i.e. System in whic Zeotropic) Type II : Systems

Type III :Systems with a minimum in the total vapour pressure. (i.e. System with a B.P. Maximum - Azeotropic) Distillation of miscible liquid pairs. 2.4 Solubility of partially miscible liquids. (i) Maximum solution temperature type : Phenol - water system. (ii) Minimum solution temperature type :Triethyl amine - water system. (iii) Maximum and minimum solution temperature type : Nicotine – water system	(i.e. System with a B.P. minimum - Azeotropic) Type III :Systems with a minimum in the total vapour pressure. (i.e. System with a B.P. Maximum - Azeotropic) Distillation of miscible liquid pairs. 2.4 Solubility of partially miscible liquids. (i) Maximum solution temperature type : Phenol - water system. (ii) Minimum solution temperature type :Triethyl amine - water system. (iii) Maximum and minimum solution temperature type : Nicotine - water system.	vapour pressure. (i.e. System with a Type III :Systems wit vapour pressure. (i.e. System with a Distillation of misc 2.4 Solubility of pa (i) Maximum solut water system. (ii) Minimum soluti amine - water system. • (iii) Maximum and type : Nicotine - water

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B.A. / B.Sc. / M.A. / M.Sc. : **B.Sc. III**		
NAME OF SUBJECT : Inorganic Chemistry		
SEM I / II / III / IV / V / VI : Sem. VI		
COURSE NUMBER (PAPER NUMBER) : **P - XIV**		
TITLE OF COURSE (NAME OF PAPER) : **Inorganic Chemistry**		
COURSE CONTENT	**OBJECTIVES**	**OUTCOME**
1) Study of F-block Elements 1.1 Lanthanides :- I) Introduction II) Electronic configuration III) Occurrence IV) Separation of Lanthanides i) Bulk separation methods ii) Individual separation of lanthanides- Mention names of methods only(Ion exchange method in detail) 1.2 Actinides :- I) Introduction II) Electronic configuration III) General Methods of preparation – a) Neutron-capture followed by β-decay b) Accelerated projectile bombardment method c) Heavy-ion bombardment method 1.3 IUPAC Nomenclature of the Super Heavy Elements with atomic numbers (Z) greater than 100.	1. To help the students to understand about lanthanide and actinide 2. To help the students to understand electronic configuration, occurrence separation techniques of lanthanides 3. To help the students to understand electronic configuration, methods of preparation of trans uranic element	1. Students understand lanthanide and actinides 2. Students understand electronic configuration, separation techniques of lanthanide 3. Students understand preaparation techniques of actinide
2) Metals and Semiconductors. 2.1 Introduction. 2.2 Properties of metallic solids. 2.3 Theories of bonding in metal. a) Free electron theory. b) Molecular orbital theory (Band theory). 2.4 Classification of solids as conductor, insulators and semiconductors on the basis of band theory. 2.5 Semiconductors: a) Types of	Students should get knowledge about; Metallic solids, bonding in metallic solids and their classification as conductor, insulator and conductor.	Students understood the preparation and conduction mechanism in semiconductor and ceramic superconductors

semiconductors - intrinsic and extrinsic semiconductors. b) Applications of semiconductors. 2.6 Superconductors : a) Ceramic superconductors - Preparation and structures of mixed oxide $YBa_2Cu_3O_{7-x}$ b) Applications of superconductors		
3) Structural Chemistry. 3.1 Structural study of following compounds. i) Diborane. ii) Borazine. iii) Xenon compounds $\rightarrow$ XeF_2, XeF_6, XeO_4 (w.r.t. VBT only.) 3.2 Structural study of Oxides of Sulphur and Phosphorous: i) Oxides of Sulphur : SO_2 and SO_3 ii) Oxides of Phosphorous : P_4O_6 and P_4O_{10}	To get Knowledge of structure and bonding of some inorganic halide and oxide compounds.	Students understood the, Hybridization concept, VSEPR theory, structure and bonding in halides and oxides of Xe, S & P.
4) Corrosion and Passivity. 4.1 **Corrosion :-** I. Introduction II. Types of corrosion III. Electrochemical theory of corrosion IV. Factors affecting the corrosion i) Position of metal in emf series. ii) Purity of metal. iii) Effect of moisture. iv) Effect of oxygen. v) Hydrogen over voltage. V. Methods of protection of metals from corrosion. 4.2 **Passivity :-** I. Definition. II. Types of passivity. III. Oxide film theory. IV. Application of passivity.	To get knowledge of the concept of corrosion and passivity.	Students understood the, Concept of corrosion and passivity, their effects, protection and applications
5. Organometallic Chemistry.	1. To help the students to understand organiometallic compounds 2.	1. Students understand concept of organometallic

5.1 Introduction - Definition. 5.2 Nomenclature of organometallic compounds. 5.3 Synthesis and structural study of alkyl and aryl compounds of Li, Be and Al. 5.4 Mononuclear carbonyl and nature of bonding in simple metal carbonyls	To help the students to understand synthesis of organometallic compounds	compounds 2. Students understand synthesis of organometallic compounds

Head of the Department
Chemistry

B.Sc. III
NAME OF SUBJECT: Organic Chemistry
SEM VI
COURSE NUMBER (PAPER NUMBER) P-XV
TITLE OF COURSE (NAME OF PAPER): Organic Chemistry

COURSE CONTENT	OBJECTIVES	OUTCOME
1 Heterocyclic compounds 1.1 Introduction and classification. 1.2 Pyrrole. 1.2.1 Methods of synthesis : i) From acetylene. ii) From furan. iii) From succinamide	To study the classification of Heterocyclic compounds. To study methods of preparation and chemical reactions of Pyrrole, Pyridine, and Quinoline	**Students gain the** Classification of He Methods of prepara Pyrrole, Pyridine,
1.2.2 Physical properties. 1.2.3 Reactivity of pyrrole : i) Basic character. ii) Acidic character. iii) Electrophilic substitution with general mechanism. 1.2.4 Chemical reactions : i) Reduction. ii) Oxidation. iii) Nitration, sulphonation and halogenation. iv) Friedel Craft's reaction. v) Coupling reaction. 1.3 Pyridine. 1.3.1 Methods of synthesis. i) From acetylene and hydrogen cyanide. ii) From piperidine. 1.3.2 Physical properties. 1.3.3 Chemical reactions i) Basic character ii) Electrophilic substitution(nitration,		

sulphonationabdbromination) reactions iii) Nucleophilic substitution - General mechanism, Reactions with sodamide, sodium hydroxide and n-Butyl lithium. 1.4 Quinoline 1.4.1 Synthesis - Skraup's synthesis 1.4.2 Physical properties. 1.4.3 Reactions of quinoline : i) Electrophilic substitution reactions - Nitration and sulphonation. ii) Nucleophilic substitution reactions - Reactions with sodamide, alkylation and arylation. iii) Reduction		
2. Carbohydrates 2.1 Introduction. 2.2 Classification and nomenclature. 2.3 Monosaccharide D-glucose - Open chain structure. 2.4 Chain lengthening of Aldoses - Kiliani synthesis. 2.5 Chain shortening of Aldoses - Weerman's reaction. 2.6 Interconversion of glucose and fructose. 2.7 Configuration of D-glucose from D-arabinose	To study the. 2.2 Classification and nomenclature. 2.3 Monosaccharide D-glucose - Open chain structure. 2.4 Chain lengthening of Aldoses - Kiliani synthesis. 2.5 Chain shortening of Aldoses - Weerman's reaction. 2.6 Interconversion of glucose and fructose. 2.7 Configuration of D-glucose from D-arabinose	Students gain the Classification and Configuration ofMonosa Objections against glucose. Ring structure of D size of ring by, Methylation method. Periodic acid treatm Disaccharides - Int - Sources, structur formulae and uses Polysaccharides - structural formula
2.8 Objections against open chain structure of D-glucose. 2.9 Muta-rotation with mechanism. 2.10 Ring structure of D-glucose - Determination of size of ring by, i) Methylation method. ii) Periodic acid treatment method. iv) X - ray analysis. 2.11 Disaccharides - Introduction, sucrose and	2.8 Objections against open chain structure of D-glucose. 2.9 Muta-rotation with mechanism. 2.10 Ring structure of D-glucose - Determination of size of ring by, i) Methylation method. ii) Periodic acid treatment method. iv) X - ray analysis. 2.11 Disaccharides -	

lactose - Sources, structural formulae and uses. 2.12 Polysaccharides - Introduction starch, - Sources, structural formulae and uses	Introduction, sucrose and lactose - Sources, structural formulae and uses. 2.12 Polysaccharides - Introduction starch, - Sources, structural formulae and uses	
3. Vitamins and Hormones 3.1 General idea of vitamins, structure and synthesis of vitamin A 3.2 General idea of hormones, structure and synthesis of Adrenaline and Thyroxin	To study the General idea of vitamins, structure and synthesis of vitamin A General idea of hormones, structure and synthesis of Adrenaline and Thyroxin	**Students gain the** General idea of vitamins, of vitamin A General idea of ho of Adrenaline and
4. Pharmaceuticals 4.1 Introduction. 4.2 Qualities of ideal drug. 4.3 Methods of classification of drugs - Classification based on the therapeutical action. 4.4 Brief idea of pencillin-G (constitution, synthesis not expected) 4.5 Synthesis and uses of the following drugs : i) Antimalerials - Paludrin. ii) Antituberculars - Isoniazide and Ethambutol. iii) C. N. S. drugs - Phenobarbitone. iv) Antidiabetics - Tolbutamide. v) Antiinflammatory drugs - Ibuprofen. vi) Antibiotic - Chloromycetin	To study the Qualities of ideal drug. Methods of classification of drugs - Classification based on the therapeutical action. Synthesis and uses of the following drugs : i) Antimalerials - Paludrin. ii) Antituberculars - Isoniazide and Ethambutol. iii) C. N. S. drugs - Phenobarbitone. iv) Antidiabetics - Tolbutamide. v) Antiinflammatory drugs - Ibuprofen. vi) Antibiotic - Chloromycetin	**Students gain the** Qualities of ideal Methods of classific based on the thera Synthesis and uses i) Antimalerials - ii) Antituberculars iii) C. N. S. drugs iv) Antidiabetics - v) Antiinflammator vi) Antibiotic - Chloromy
5 Synthetic dyes. 5.1 Introduction, Qualities of good dye. 5.2. Classification based on constitution and methods of applications. 5.3 Witt's theory - Colour and constitution. 5.4 Synthesis of Orange IV, Malechite green, phenolphthalein	**To study the:** Qualities of good dye. Classification based on constitution and methods of applications. Witt's theory - Colour and constitution. Synthesis of Orange IV, Malechite green, phenolphthalein	**Students gain the** Qualities of good Classification base of applications. Witt's theory - Colour Synthesis of Oran phenolphthalein
6 Agrochemicals. 6.1 General	**To study the:**	**Students gain the**

idea of agrochemicals including pyrethroides. 6.2 Synthesis and uses of the following agrochemicals : i) Indole-3-acetic acid. ii) Monocrotophos. iii) Methoxychlor. iv) Ethophan. v) Carbaryl.	General idea of agrochemicals including pyrethroides. Synthesis and uses of the following agrochemicals : i) Indole-3-acetic acid. ii) Monocrotophos. iii) Methoxychlor. iv) Ethophan. v) Carbaryl.	General idea of ag pyrethroides. Synthesis and uses agrochemicals : i) Indole-3-acetic ii) Monocrotophos. iii) Methoxychlor. iv) Ethophan. v) Carbaryl.of TMS

B.Sc. III

NAME OF SUBJECT: Analytical and Industrial Organic Chemistry

SEM VI

COURSE NUMBER (PAPER NUMBER) P-XVI

TITLE OF COURSE (NAME OF PAPER): Analytical and Industrial Organic Chemistry

COURSE CONTENT	OBJECTIVES	OUTCOME
1. Soaps and Detergents. [08] 1.1 Soap i) Raw materials. ii) Types of soaps. iii) Manufacture of soap - Hot process. iv) Cleansing action of soaps. 1.2 Detergents i) Raw materials. ii) Types of detergents - Cationic, anionic, amphoteric, neutral detertents. iii) Preparation of teepol and deriphat. 1.3 Comparison between soaps and detergents	**To study the:** Soap Raw materials. Types of soaps. Manufacture of soap - Hot process. Cleansing action of soaps. Detergents Raw materials. Types of detergents - Cationic, anionic, amphoteric, neutral detertents. Preparation of teepol and deriphat. Comparison between soaps and detergents	**Students gain the understanding of:** Soap and detergents, their raw materials, manufacturing processes, cleansing action of soap and types of detergents
2. Synthetic polymers. [08] 2.1 Introduction. 2.2 Classification : i) According to origin, composition method of preparation and general physicalproperties. ii) Classification based upon structure. 2.3 Process of addition polymerisation - free radical polymerisation of alkenes and Dienes. 2.4 Ionic polymerisation. 2.5 Ziegler - Natta polymerisation. 2.6	**To study the:** Classification of polymer. Process of addition polymerisation - free radical polymerisation of alkenes and Dienes. Methods of preparation and uses of : i) Polythene. ii) Polystyrene iii) PVC. iv) Phenol formaldehyde resin. v) Urea formaldehyde resin vi) Poly urethane 2.7 Natural rubber : General	**Students gain the understanding of:** - Polmerisation processes, Methods of preparation and uses of : i) Polythene. ii) Polystyrene iii) PVC. iv) Phenol formaldehyde resin. v) Urea formaldehyde resin vi) Poly urethane 2.7 Natural rubber : General idea and vulcanisation. 2.8 Synthetic

Methods of preparation and uses of : i) Polythene. ii) Polystyrene iii) PVC. iv) Phenol formaldehyde resin. v) Urea formaldehyde resin vi) Poly urethane 2.7 Natural rubber : General idea and vulcanisation. 2.8 Synthetic rubbers : Synthesis and uses of - i) Polychloroprene, ii) Buna rubber - Buna N and Buna S.	idea and vulcanisation. 2.8 Synthetic rubbers : Synthesis and uses of - i) Polychloroprene, ii) Buna rubber - Buna N and Buna S.	rubbers : Synthesis and uses of - i) Polychloroprene, ii) Buna rubber - Buna N and Buna S
3. Sugar and Alcohol Industry [09] 3.1 Manufacture of raw cane sugar. 3.2 Refining of raw sugar. 3.3 White sugar. 3.4 By-products of sugar industry. 3.4.1 Manufacture of ethyl alcohol from molasses 3.4.2 Rectified spirit, Denatured spirit absolute alcohol and power alcohol. 3.4.3 By-products of alcohol industry	**To study the:** Manufacture of raw cane sugar. Refining of raw sugar. White sugar. By-products of sugar industry. Manufacture of ethyl alcohol from molasses Rectified spirit, Denatured spirit absolute alcohol and power alcohol. By-products of alcohol industry.	**Students gain the understanding of:** Manufacture of raw cane sugar. Refining of raw sugar. White sugar. By-products of sugar industry. Manufacture of ethyl alcohol from molasses Rectified spirit, Denatured spirit absolute alcohol and power alcohol. By-products of alcohol industry.
4. Textile chemistry [4.1 Introduction, classification of fibers. 4.2 Sizing: object of sizing, sizing ingredients and their functions. 4.3 General idea of processes like singeing, desizing, scouring. 4.4 Bleaching: i) Brief study of the outline of the process of bleaching cotton and synthetic material. 4.5 Dyeing : Study of dyeing of cellulosic material and synthetic fibers with dyes like direct,vat, reactive and disperse dyes	**To study the:** Classification of fibers. Sizing: object of sizing, sizing ingredients and their functions. General idea of processes like singeing, desizing, scouring, Bleaching, Dyeing	**Students gain the understanding of:** Classification of fibers. Sizing: object of sizing, sizing ingredients and their functions. General idea of processes like singeing, desizing, scouring, Bleaching, Dyeing
5. Green Chemistry. 5.1 Introduction - Twelve	**To study the:** Twelve principles of green	**Students gain the understanding of:** Twelve

principles of green chemistry. 5.2 Zeolites - Friedel Craft's alkylation and acylation, oxidation of benzene to phenol and benzoquinone, Reduction of benzoquinone to hydroquinone. 5.3 Biocatalytic reaction - Hydroxylation and oxidation using enzymes. 5.4 Introduction to microwave assisted reactions	chemistry. Zeolites - Friedel Craft's alkylation and acylation, oxidation of benzene to phenol and benzoquinone, Reduction of benzoquinone to hydroquinone. Biocatalytic reaction - Hydroxylation and oxidation using enzymes. Introduction to microwave assisted reactions	principles of green chemistry. Zeolites - Friedel Craft's alkylation and acylation, oxidation of benzene to phenol and benzoquinone, Reduction of benzoquinone to hydroquinone. Biocatalytic reaction - Hydroxylation and oxidation using enzymes. Introduction to microwave assisted reactions
6. Chromatography 6.1 Introduction. 6.2 General principles. 6.3 Classification. 6.4 Study of following chromatographic techniques with reference to principle, methodology and applications. i) Paper chromatography. ii) Column chromatography. iii) Thin layer chromatography. iv) Gas chromatography	**To study the:** General principles. Classification. Study of following chromatographic techniques with reference to principle, methodology and applications. i) Paper chromatography. ii) Column chromatography. iii) Thin layer chromatography. iv) Gas chromatography	**Students gain the understanding of:** General principles. Classification. Study of following chromatographic techniques with reference to principle, methodology and applications. i) Paper chromatography. ii) Column chromatography. iii) Thin layer chromatography. iv) Gas chromatography

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Chemistry

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PRINCIPAL   Page 51

Program Outcome
Name of Department: Physics

1. Demonstrate a rigorous understanding of the core theories and principles of physics, which include mechanics, electromagnetism, thermodynamics, quantum mechanics, electronics and nuclear physics.
2. Students will demonstrate understanding of the applications of numerical techniques and apply critical reasoning skills to solve physics related problems.
3. Demonstrate proficiency in the measurement, analysis and interpretation of data.
4. Communicate scientific information in oral, written, and graphical formats.

Priyanka

Head of the Department
Physics

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Principal
Hemuji Chandele College
Shelgaon(R) Tal-Barshi Dist-Solapur

Priyanka

Signature of HOD   PRINCIPAL   Signature of Lecturer

Page 1

Hemuji Chandele College, Shelgaon R

Program Outcome

Name of Department: Physics

- ☐ Demonstrate a rigorous understanding of the core theories and principles of physics, which include

- mechanics, electromagnetism, thermodynamics, quantum mechanics, electronics and nuclear

- physics.

- Students will demonstrate understanding of the applications of numerical techniques and apply

- critical reasoning skills to solve physics related problems.

- Demonstrate proficiency in the measurement, analysis and interpretation of data.

- Communicate scientific information in oral, written, and graphical formats.

B.A. / B.Sc. / M.A. / M.Sc.: B.Sc.
NAME OF SUBJECT: Physics
SEM I / II / III / IV / V / VI : Sem-I
COURSE NUMBER (PAPER NUMBER): Paper I

COURSE CONTENT	OBJECTIVE	OUTCOME
Moment of Inertia Review of M.I., Moment of Inertia of 1) Circular disc 2) Rectangular lamina 3) Spherical Shell 4) Fly wheel.	To understand the concept of Moment of Inertia and to calculate moment of inertia of various rigid bodies	Student understood the important concepts of Moment of Inertia. The students are able to calculate moment of inertia of various rigid bodies.
Pendulums Introduction, Theory of compound pendulum, Bar pendulum, Kater's Pendulum, Bassel's Theory, Bifilar pendulum (parallel suspensions of equal lengths), Torsional Pendulum.	To understand theory of compound pendulum. To study various pendulums like Bar pendulum, Kater's Pendulum, Bifilar pendulum, Torsional Pendulum.	Students understood the working theory of compound pendulum. Students are successfully able to understand theory of various pendulums like Bar pendulum, Kater's Pendulum, Bifilar pendulum, Torsional Pendulum.

Elasticity Introduction, Equivalence of shear strain to compression and extension strains, Relation between elastic constants, Poisson's ratio of rubber tube (Theory and experimental method)	To understand the concept of elasticity. To study elastic constant and relation between them. To study the Poisson's ratio of rubber tube.	Students understood the concept of elasticity. Students understood the relation between elastic constants. Students also studied the theory and experimental method to study Poisson's ratio.
Surface Tension Review of S.T., relation between excess pressure and surface tension, excess pressure inside a liquid drop and soap bubble, Jaeger's method to determine Surface Tension, Factors affecting Surface Tension, Applications of Surface Tension.	To understand the concept of surface tension. To understand relation between excess pressure and surface tension, excess pressure inside a liquid drop and soap bubble. To study the factors affecting Surface Tension and Applications of Surface Tension.	Students understood the concept of surface tension. Students understood the relation between excess pressure and surface tension, excess pressure inside a liquid drop and soap bubble. Students understood the factors affecting Surface Tension and Applications of

		Surface Tension.
Viscosity and Fluid dynamics Introduction, Newton's law of viscosity, streamline and turbulent flow, Critical velocity and Reynolds number, Equation of continuity, Energy possessed by liquid, Poiseuille's equation, Bernoulli's theorem and its applications to 1) Venturimeter 2) Automiser. Factors Affecting on viscosity.	To understand the concept of Viscosity and Fluid dynamics. To understand Energy possessed by liquid, Poiseuille's equation, Bernoulli's theorem and its applications.	Students understood concept of Viscosity and Fluid dynamics. To understand Energy possessed by liquid, Poiseuille's equation, Bernoulli's theorem and its applications.

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COURSE OUTCOME

Name of Department: Physics

		Surface Tension.
Viscosity and Fluid dynamics Introduction, Newton's law of viscosity, streamline and turbulent flow, Critical velocity and Reynolds number, Equation of continuity, Energy possessed by liquid, Poiseuille's equation, Bernoulli's theorem and its applications to 1) Venturimeter 2) Automiser. Factors Affecting on viscosity.	To understand the concept of Viscosity and Fluid dynamics. To understand Energy possessed by liquid, Poiseuille's equation, Bernoulli's theorem and its applications.	Students understood concept of Viscosity and Fluid dynamics. To understand Energy possessed by liquid, Poiseuille's equation, Bernoulli's theorem and its applications.

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COURSE OUTCOME

Name of Department: Physics

COURSE CONTENT	OBJECTIVES	OUTCOME
Geometrical Optics and aberrations Introduction, Fermat's principle, Deduction of laws of reflection and refraction by Fermat's principle, Chromatic and Spherical aberration, methods to minimize Chromatic and Spherical aberrations.	To understand Fermat's Principle, its application, Aberration and its types.	The students understand Fermat's principle and Aberration.
Optical Instruments Introduction, Types of eye-pieces, Gauss eye piece, Ramsden's eye-piece, Huygen's eye-piece, Construction, working and Application of Spectrometer and Optical	To get knowledge of types, construction and working of eye pieces, spectrometer and optical bench.	The students get knowledge of types, construction and working of eye pieces, spectrometer and optical bench.

bench.		
Interference Introduction, Interference in parallel faced thin film (Reflected light only), wedge shaped film, Newton's rings and its applications.	To get knowledge of interference phenomenon in parallel faced, wedge shaped thin film and Newton's rings experiment.	The students get knowledge of interference phenomenon in parallel faced, wedge shaped thin film and Newton's rings experiment.
Diffraction Introduction, Types of diffraction, Plane diffraction grating and its elementary theory, its application to determine wavelength, Comparison between prism and grating spectra	To get knowledge of Types of diffraction, Plane diffraction and its elementary theory, its applications.	The students get knowledge of Types of diffraction, Plane diffraction and its elementary theory, its applications.

Laser Introduction, Spontaneous and Stimulated emission and absorption, Einstein's Coefficients, Population inversion, Optical Pumping, Cavity resonator, He-Ne and Ruby Laser, Properties and application.	To get knowledge of Laser basics, construction and working of He-Ne and Ruby Laser.	The students get knowledge of Laser basics, construction and working of He-Ne and Ruby Laser.

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COURSE OUTCOME

Name of Department: Physics

B.A. / B.Sc. / M.A. / M.Sc.: B.Sc.

NAME OF SUBJECT: Physics

SEM I / II / III / IV / V / VI: Sem-III

COURSE NUMBER (PAPER NUMBER) : V

TITLE OF COURSE (NAME OF PAPER): General Physics, Heat and Sound

COURSE CONTENT	OBJECTIVE	OUTCOME
Vectors 1.1 Scalar and vector triple product 1.2 Scalar and vector fields 1.3 Del operator 1.4 Gradient of a scalar 1.5 Divergence of a vector, curl of vector and their physical significance	To get knowledge of Scalar and vector triple product, Scalar and vector fields, Del operator, Gradient of a scalar, Divergence of a vector, curl of vector and their physical significance	The students get knowledge of Scalar and vector triple product, Scalar and vector fields, Del operator, Gradient of a scalar, Divergence of a vector, curl of vector and their physical significance
Precessional Motion 2.1 Precession 2.2 Nutation 2.3 Gyroscope 2.4 Lanchester's rules 2.5 Gyrostatic pendulum 2.6 Motion of rolling disc 2.7 Gyroscopic applications in brief	To understand Precession, Nutation, Lanchester's rules, Gyroscope and its applications	The students understand understand Precession, Nutation, Lanchester's rules, Gyroscope and its applications
Elasticity 3.1 Bending of a beam 3.2 Bending moment 3.3 Cantilever 3.4 Centrally loaded beam	To get knowledge of elasticity, Bending moment, Cantilever and expression for Y and η of Flat spiral spring.	The students get knowledge of elasticity, Bending moment, Cantilever and expression for Y and η of Flat spiral spring.

3.5 Flat spiral spring expression for Y and η		
Viscosity 4.1 Viscosity of liquid by rotating cylinder method 4.2 Searle's viscometer 4.3 Ostwald's viscometer	To get knowledge of Viscosity, Searle's viscometer and Ostwald's viscometer.	The students get knowledge of Viscosity, Searle's viscometer and Ostwald's viscometer.
Heat 5.1 Entropy 5.2 Change in entropy 5.3 Physical concept and physical significance of entropy 5.4 T – S diagram 5.5 Entropy of a perfect gas 5.6 Entropy of a steam	To study Entropy, physical significance of entropy, T- S diagram and Entropy of a perfect gas &steam.	The students understand Entropy, physical significance of entropy, T-S diagram and Entropy of a perfect gas &steam.
Sound 6.1 Transducer 6.2 Pressure microphone 6.3 Moving coil Loudspeaker 6.4 Acoustics and its affecting	To get knowledge of Transducer, Acoustics and its affecting factors, Reverberation time, Requirements of good acoustics, Sabine's formula and production, Detection,	The students get knowledge of Transducer, Acoustics and its affecting factors, Reverberation time,

factors 6.5 Reverberation time 6.6 Optimum reverberation time 6.7 Requirements of good acoustics 6.8 Sabine's formula 6.9 Ultrasonic production by piezoelectric method 6.10 Detection of ultrasonic 6.11 Properties and applications of ultrasonic	Properties and applications of ultrasonic.	Requirements of good acoustics, Sabine's formula and production, Detection, Properties and applications of ultrasonic.

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COURSE OUTCOME

Name of Department: Physics

B.A. / B.Sc. / M.A. / M.Sc.

NAME OF SUBJECT Physics

SEM I / II / III / IV / V / VI

COURSE NUMBER (PAPER NUMBER) VI

TITLE OF COURSE (NAME OF PAPER) ELECTRONICS

COURSE CONTENT	OBJECTIVES	OUTCOME
Transistor amplifier : 1.1 Transistor biasing: voltage divider bias 1.2 Two stage R-C coupled transistor amplifier 1.3 Frequency response curve of an amplifier 1.4 Feedback 1.5 Effect of negative feedback on the frequency response curve 1.6 Differential amplifier 1.7 Modes of operation 1.8 Common mode and differential mode signals 1.9 Comparison	To understand biasing and its need in its amplifiers. Modifications in amplifiers with feedback. Differential amplifier.	The students understand amplifier and modifications in amplifiers.

between normal amplifier and differential amplifier		
Oscillator : 2.1 Types of waveforms 2.2 Oscillations from tank circuit 2.3 Barkhausen's criterion for sustained oscillations 2.4 Concept of AF and RF Oscillator 2.5 Phase shift oscillator 2.6 Colpitt's oscillator 2.7 Hartley oscillator, 2.8 Crystal Oscillator (qualitative treatment only)	To understand oscillators. theory of oscillations and different types of oscillators.	The students understand oscillators and different types of oscillators
Unipolar Devices: 3.1 FET: Construction, operation and characteristics 3.2 Application of FET as VVR 3.3 UJT:	To study unipolar devices –FET and UJT with its construction and operation and application	The students understand FET and UJT with its construction and operation and application

Construction, operation and characteristics 3.4 UJT as voltage sweep generator		
Digital Electronics : 4.1 De Morgan's theorems 4.2 Half adder 4.3 Full adder 4.4 Construction and working of RS flip flop 4.5 Construction and working of JK flip flop	To study digital electronics with different gates with related adders and flip-flops.	The students understand digital electronics with different gates with related adders and flip-flops
Regulated power supply 5.1 Regulated power supply (with block diagram) and its need 5.2 Line and load regulation 5.3 Transistor Series power supply 5.4 IC voltage regulators 5.5 Fixed output voltage regulators (using IC 78XX and 79XX) 5.6 Dual power supply	To study different regulated power supply with IC voltage regulators	The students studed different regulated power supply with IC voltage regulators

using 3

Electronic Instruments: 6.1 Principle, Construction and working of CRT 6.2 Block diagram of CRO 6.3 Uses of CRO 6.4 Block diagram of digital multimeter (DMM) and its applications	To study Electronic Instruments-CRO and DMM	The students studed CRO and DMM

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COURSE OUTCOME

Name of Department: Physics

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc.	
NAME OF SUBJECT : Physics	
SEM I / II / III / IV / V / VI : IV	
COURSE NUMBER (PAPER NUMBER) VI	
TITLE OF COURSE (NAME OF PAPER) OPTICS	

COURSE CONTENT	OBJECTIVES	OUTCOME
Cardinal points: 1.1 Lagrange's equation 1.2 Cardinal points of optical system 1.3 Graphical construction of image using cardinal points 1.4 Newton's formula 1.5 Relation between focal lengths for any optical system 1.6 Relation between lateral, axial and angular magnifications 1.7 Thick lens (introduction)	To study Cardinal points, Newton's formula, Relation between focal lengths for any optical system, Relation between lateral, axial and angular magnifications, Thick lens (introduction) combination of	Students studed Cardinal points, Newton's formula, Relation between focal lengths for any optical system, Relation between lateral, axial and angular magnifications, Thick lens (introduction) combination of two thin lenses

1.8 combination of two thin lenses	two thin lenses	
Interference of light: 2.1 Michelson's interferometer 2.2 Applications of Michelson's interferometer to measure i) wavelength of light ii) Difference in wavelengths and iii) Refractive index of thin film 2.3 Construction and working of Michelson's interferometer 2.4 Superiority of F.P. interferometer over Michelson's interferometer	To study Michelson's interferometer and Michelson's interferometer	Students studed Michelson's interferometer and Michelson's interferometer
Diffraction of light: 3.1 Fresnel's half period zones 3.2 Explanation of rectilinear propagation of light 3.3 Zone plate 3.4 Fresnel's diffraction at straight edge	To study Fresnel's half period zones, Explanation of rectilinear propagation of light, Zone plate,, Fresnel's diffraction at straight edge	Students studed Fresnel's half period zones, Explanation of rectilinear propagation of light, Zone plate,, Fresnel's diffraction at straight edge

Resolving power: 4.1 Geometrical and spectral resolution 4.2 Distinction between magnification and resolution 4.3 Rayleigh's criterion for the limit of resolution 4.4 Modified Rayleigh's criterion 4.5 R.P. of plane diffraction grating 4.6 R.P. of prism	To study Resolving power, Geometrical and spectral resolution, Distinction between magnification and resolution, Rayleigh's criterion for the limit of resolution, Modified Rayleigh's criterion, R.P. of plane diffraction grating, R.P. of prism	Students studed Resolving power, Geometrical and spectral resolution, Distinction between magnification and resolution, Rayleigh's criterion for the limit of resolution, Modified Rayleigh's criterion, R.P. of plane diffraction grating, R.P. of prism
Polarization: 5.1 Double refraction 5.2 Huygen's explanation of double refraction through uni-axial crystals 5.3 Nicols prism 5.4 Phase retardation plates 5.5 Elliptically and circularly polarized light 5.6 Optical rotation 5.7 Laws of rotation of plane of polarization 5.8 Applications a) Polarimeter b) Liquid crystal Displays	To study Polarization, Double refraction Huygen's explanation of double refraction through uni-axial crystals, Nicols prism, Phase retardation plates, Elliptically and circularly polarized light, Optical rotation,	Students studed Polarization, Double refraction Huygen's explanation of double refraction through uni-axial crystals, Nicols prism, Phase retardation plates, Elliptically and circularly polarized light, Optical rotation, Laws of rotation of

	Laws of rotation of plane of polarization, Applications	plane of polarization, Applications
Optical Fibers: 6.1 Structure and types of fibers 6.2 Numerical aperture (definition only) 6.3 Pulse dispersion in step index fiber 6.4 Fiber optic communication system (Qualitative treatment only) 6.5 Advantages of optical fibre	To study structure and types of fibers, Numerical aperture (definition only), Pulse dispersion in step index fiber, Fiber optic communication system Advantages of optical fibre	Students studed structure and types of fibers, Numerical aperture (definition only), Pulse dispersion in step index fiber, Fiber optic communication system Advantages of optical fiber

Hemuji Chandele College, Shelgaon R

COURSE OUTCOME

Name of Department: Physics

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc.	
NAME OF SUBJECT : Physics	
SEM I / II / III / IV / V / VI : IV	
COURSE NUMBER (PAPER NUMBER) VII	
TITLE OF COURSE (NAME OF PAPER) : modern physics	

Course contents	objectives	outcomes
1. Theory of relativity: [9 hr] 1.1 Inertial frame of reference 1.2 Galilean transformation 1.3 Invariance of laws of mechanics under Galilean transformation 1.4 Ether hypothesis 1.5 Michelson-Morley experiment 1.6 Einstein's postulates of the special theory of relativity 1.7 Lorentz transformation	To study . Theory of relativity Inertial frame of reference, Invariance of laws of mechanics under Galilean transformation and Variation of time with velocity	Students studied inertial frame of reference, galiean transformation also ether hypothesis loretntz transformation variation of time with velocity, velocity addition theorem

1.8 Variation of length with velocity 1.9 Variation of time with velocity 1.10 Velocity addition theorem 1.11 Variation of mass with velocity 1.12 Mass energy relation 1.13 Twin paradox		
2. Matter waves: [6 hr] 2.1 De Broglie's hypothesis of matter waves 2.2 De Broglie's wavelength 2.3 Particle velocity, group velocity , phase velocity & their interrelationship 2.4 Properties of matter waves 2.5 Bohr's quantum condition on the basis of matter wave hypothesis 2.6 Heisenberg's uncertainty principle and its illustrations	To study De Broglie's hypothesis of matter waves, 3 Particle velocity, group velocity , phase velocity & their interrelationship and Heisenberg's uncertainty principle	Students studied the concept of De Broglie's hypothesis of matter waves, 3 Particle velocity, group velocity , phase velocity & their interrelationship and Heisenberg's uncertainty principle
3. Vector Atom model: [8 hr] 3.1 Space quantization 3.2 Spin hypothesis 3.3 Stern-Gerlache experiment 3.4 Quantum numbers associated with vector atom model 3.5 Pauli's exclusion principle 3.6 Spin orbit coupling	To study Space quantization Spin hypothesis Stern-Gerlache experiment Quantum numbers associated with vector atom model Pauli's exclusion principle	Students studied the concept of Space quantization Spin hypothesis Stern-Gerlache experiment Quantum numbers associated with vector atom model Pauli's exclusion principle Spin orbit coupling

		Hund's rule
3.7 Hund's rule 3.8 Total angular momentum 3.9 L-S coupling 3.10 j-j coupling 3.11 Zeeman effect 3.12 Normal and anomalous Zeeman effect 3.13 Debye's explanation of normal Zeeman effect	Spin orbit coupling Hund's rule	
4. Compton effect: [3 hr] 4.1 Compton Effect 4.2 Expression for change in wavelength for scattered photon 4.3 Experimental verification of Compton effect	To study Compton effect and expression for change in wavelength for scattered photon Experimental verification of Compton effect	Students studied the concept of Compton effect and expression for change in wavelength for scattered photon Experimental verification of Compton effect
5. Nuclear Energy sources: [4 hr] 5.1 Neutron induced nuclear reaction 5.2 Nuclear fission 5.3 Energy released in fission 5.4 Chain reaction (Atomic Bomb) 5.5 Nuclear reactor 5.6 Atomic energy in India	To study nuclear energy sources, neutron in Neutron induced nuclear reaction Nuclear fission Energy released in fission Chain reaction	Students studied nuclear energy sources, neutron induced nuclear reactions and nuclear fission and chain reaction

DEPARTMENT OF MICROBIOLOGY

Program Outcome [B.Sc. I – Microbiology]

- Historical development of microbiology

- Scope of microbiology

- Beneficial and harmful effects of microorganisms

- Diversity in types of microorganisms

- General characters of different microorganism

- Principles of microscopy and use of it to observe and study microbes

- Different staining techniques, Sterilization Techniques, Cultivation techniques of microorganisms, Methods of Pure culture, Maintenance and preservation of pure cultures

- Basic Biochemistry, Microbial Metabolism, Microbial Nutrition and Growth

- Applied branches of microbiology such as water microbiology, sewage microbiology, milk microbiology, medical microbiology

Program Outcome [B.Sc. II – Microbiology]

- Ultra structure and Functions different organelle of bacterial cell

- Bacterial Growth, Effect of Environmental factors on Bacterial growth, Metabolism

- Virology

- Structure of nucleic acids & Replication of Bacterial DNA

- Gene, Genetic code and Transcription, Plasmids

- Bacterial Mutation

- Immunity

- Antigen and Antibody

- Clinical Microbiology

- Pathogenecity, Microbial Diseases

- scope of Industrial microbiology, Fermentation Media, Screening, Inoculum Development and Scale Up, Microbiological assays, Specific fermentations

Program Outcome [B.Sc. III – Microbiology]

- Classification of Viruses, Reproduction of bacterial and animal viruses, Plant Viruses, Techniques in Virology

- Soil microorganisms, types and their role in elemental cycle

- Composting and Biodegradation, Plant diseases Applications of Biotechnology in Agriculture
- Adaptive Immunity, Monoclonal antibodies, Major Histocompatibility complex, Complement system, Immunological disorders

- ABO blood group system, Rh blood group system, Blood transfusion reaction and its complications

- Food Microbiology, Dairy Microbiology, Industrial production of Streptomycin,Lysin, rDNA products, Production of alcoholic beverages, Downstream processing and quality control

- Basic concepts of microbial genetics, Effect of mutation in bacteria, Genetic engineering and Protein engineering, Techniques in molecular biology, Bioinformatics

- Enzyme, Enzyme kinetics and regulation, Extraction, purification and assay of enzymes
- Bioenergetics, Biosynthesis of Nucleotides , Protein ,Peptidoglycan

- Air microbiology, Marine microbiology and Fresh water ecosystem, Extremophiles, Geomicrobiology,

- Environmental impact assessment and Industrial Waste Managemen

- Clinical Bacteriology, Mycology, Parasitology, Virology , Chemotherapy

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Tal. Barshi, Dist. Solapur (Maharashtra) 413222

COURSE OUTCOME

Name of Department: - Microbiology

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc		
NAME OF SUBJECT : Microbiology		
SEM I / II / III / IV / V / VI : Sem I		
COURSE NUMBER (PAPER NUMBER) : PAPER –I		
TITLE OF COURSE (NAME OF PAPER) :- Introduction to Microbiology and Microbial diversity		
COURSE CONTENT	OBJECTIVES	OUTCOME
UNIT–I: History of Development of Microbiology	TO know the historical events occur for the development of advance Microbiology. To know the various contributions in development of Microbiology by the scientists	Students will come to know or familiar the history of microbiology and various contributions by the scientists
UNIT –II: Diversity of microbial world	To know the microbial diversity and identify through morphological , cultural characterization and biochemical characterization	Students will be able to identify microorganisms through morphological, cultural and biochemical characterization.
UNIT III: General characters of different groups of microorganisms –Cellular & cellular.	To study general characters of various groups of microorganisms cellular as well as acellular	Students will come to know to general characters of various groups of microorganisms cellular as well as acellular
UNIT – IV: An overview of Scope of Microbiology	To know the various branches of Microbiology. To know the beneficial and harmful roles of various microorganisms.	Students will be able to know various branches of Microbiology and beneficial and harmful roles of microorganisms Signature

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COURSE OUTCOME

Name of Department _____Microbiology_____

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc	
NAME OF SUBJECT : Microbiology	
SEM I / II / III / IV / V / VI : Sem I	
COURSE NUMBER (PAPER NUMBER) : II	
TITLE OF COURSE (NAME OF PAPER) Microbial techniques	

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1:Microscopy	To understand the Principle and applications of Microscope	Students will use microscope efficiently
Unit 2: Staining techniques	To aware of various types of stains. To provide an intensive and in depth learning about various staining methods	Students will apply the theoretical knowledgeto perform different staining methods to stain bacteria & study different organelle of bacteria
Unit 3:sterilization techniques	To study various terms related to sterilization techniques	students will : • be acquainted with various sterilization techniques • Use various methods to control microbes.
Unit 4:Cultivation techniques of microorganisms	To train the students to prepare culture media & cultivate various types of microorganismTo know the preservation techniques for maintenance of	Students will be able to cultivate various microorganisms & also will be able to maintain pure cultures of microorganisms

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COURSE OUTCOME

Name of Department ____Microbiology_____

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc		
NAME OF SUBJECT : Microbiology		
SEM I / II / III / IV / V / VI : Sem I		
COURSE NUMBER (PAPER NUMBER) : II		
TITLE OF COURSE (NAME OF PAPER) Microbial techniques		
COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1:Microscopy	To understand the Principle and applications of Microscope	Students will use microscope efficiently
Unit 2: Staining techniques	To aware of various types of stains. To provide an intensive and in depth learning about various staining methods	Students will apply the theoretical knowledgeto perform different staining methods to stain bacteria & study different organelle of bacteria
Unit 3:sterilization techniques	To study various terms related to sterilization techniques	students will : • be acquainted with various sterilization techniques • Use various methods to control microbes.
Unit 4:Cultivation techniques of microorganisms	To train the students to prepare culture media & cultivate various types of microorganisms To know the preservation techniques for maintenance of pure culture	Students will be able to cultivate various microorganisms & also will be able to maintain pure cultures of microorganisms

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COURSE OUTCOME

Name of Department ___Microbiology_____

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc		
NAME OF SUBJECT : Microbiology		
SEMESTER II		
COURSE NUMBER (PAPER NUMBER) : **PAPER III**		
TITLE OF COURSE (NAME OF PAPER) **(Microbial Biochemistry and Physiology)**		
COURSE CONTENT	OBJECTIVES	OUTCOME
UNIT-I Basic Biochemistry	To understand the structure and applications of various macromolecules like carbohydrates, proteins lipids, DNA and RNA	Students will use knowledge in day today life
UNIT-II-Microbial Enzymes	To understand the structure mechanism of action and applications of various enzymes	Students will apply the knowledge in studying living system and role of enzymes
UNIT- III - Microbial Metabolism:-	To study basic concepts of metabolism	The students will know about how organisms use c source for their growth
UNIT- IV - Microbial Nutrition and Growth	To make aware the students to prepare culture media role of nutrient and nutritional classification pure culture	Students will be able to cultivate various microorganisms & also will be able to grow microorganisms using knowledge of nutritional requirements

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COURSE OUTCOME

Name of Department ____Microbiology_____

B.A. / B.Sc. / M.A. / M.Sc. : B. Sc		
NAME OF SUBJECT : Microbiology		
SEMESTER II		
COURSE NUMBER (PAPER NUMBER) : **PAPER IV**		
TITLE OF COURSE (NAME OF PAPER) **(Applied Microbiology)**		
COURSE CONTENT	OBJECTIVES	OUTCOME
UNIT-I - WATER MICROBIOLOGY	To understand the microbial flora of water, causes of water pollution, examination of water and control of pollution	Students will use knowledge in day today life. They can do the microbial examination of water. And water potability
UNIT-II- SEWAGE MICROBIOLOGY	To understand the composition, types, microbial flora, parameters for strength of sewage like B.O.D and C.O.D, significance of sewage treatment	Students will apply the knowledge in studying role of microorganisms in treatment of sewage & its significance. Dangerous effects of discharge of sewage in natural streams.
UNIT- III - MILK MICROBIOLOGY	To study basic concepts of milk, milk composition, contamination of milk, microbiological examination , preservation of milk, Pasteurization etc.	The students will know about role of organisms in contamination of milk, use of various methods of Pasteurization of milk so as to preserve the milk. They can use knowledge in day to day life
UNIT- IV - MEDICAL MICROBIOLOGY	To make aware the students about medical terminologies, in general basic information of infection, disease, cause, spread, types, prevention and control	Students will be enriched in knowledge about harmful activities of microorganisms using knowledge and using this they will come to know about pathogens, types of diseases spread control , vaccination.

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COURSE OUTCOME

Name of Department ____Microbiology_____

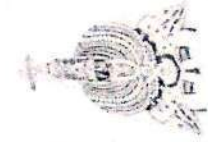| B.A. / B.Sc. / M.A. / M.Sc. : B.Sc		
NAME OF SUBJECT : Microbiology		
SEM I / II / III / IV / V / VI : Sem III		
COURSE NUMBER (PAPER NUMBER) : Paper V		
TITLE OF COURSE (NAME OF PAPER) Cytology and Physiology of Microorganisms		
COURSE CONTENT	OBJECTIVES	OUTCOME
Unit I : Ultra structure and Functions	To understand the structure of and functions of bacterial cell organelles	Students will know about fundamental structure of organelles of bacteria
Unit II: Bacterial Growth	To understand the growth pattern of bacteria	Students will know the growth of bacteria &apply the theoretical knowledge to various aspects
Unit III: Effect of Environmental factors on Bacterial growth	To study the effects of various environmental factors on bacterial growth	students will apply knowledge in studying effects of various environmental factors on bacterial growth
Unit IV: Metabolism	To understand the metabolism students to prepare culture media & cultivate various types of microorganisms	Students will be able to describe metabolism of glucose , modes of ATP generation by various Methods
Unit V Virology	To study basic structure of viruses and their cultivation	Students will know about structure of viruses and their cultivation

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COURSE OUTCOME

Name of Department: - Microbiology

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc.

NAME OF SUBJECT : Microbiology

SEM I / II / III / IV / V / VI : Sem III

COURSE NUMBER (PAPER NUMBER) : Paper-VI

TITLE OF COURSE (NAME OF PAPER) :- : Bacterial Genetics

COURSE CONTENT	OBJECTIVES	OUTCOME
UNIT–I: Structure of nucleic acids & Replication of Bacterial DNA	To understand the detail structure of nucleic acids. To learn the concept of bacterial DNA replication	Students will be able to know or familiar the structure of DNA and the concept of bacterial DNA replication
UNIT –II: Gene, Genetic code and Transcription	To study or learn the concept of Gene, Genetic code and Transcription	Students will be able to learn or understand the concept of Gene, Genetic code and Transcription.
UNIT III: Bacterial Mutation	To study or learn the concept of bacterial mutation through mutagenesis by different mutagens	To study or learn the concept of bacterial mutation through mutagenesis by different mutagens
UNIT – IV: Plasmids	To understand the basic concept of covalently closed circular DNA To know various functions of plasmids and transformation	Students will be able to know the concept of Plasmids
Unit – V :Bacterial Recombination	To study or learn the concept of bacterial recombination	Students will be able to know the concept of bacterial recombination

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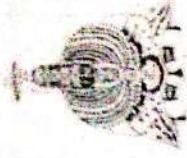Hemuji Chandele College
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COURSE OUTCOME

Name of Department ___ Microbiology ___

B.A. / **B.Sc.** / M.A. / M.Sc.: **B.Sc.**

NAME OF SUBJECT : Microbiology

SEM I / II / III / IV / V / VI IV

COURSE NUMBER (PAPER NUMBER) VII

TITLE OF COURSE (NAME OF PAPER) Immunology & medical microbiology

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit 1:Immunity	To understand the concept of immunity & its mechanism To study the structure & function of cells and organs of immune system	students will be aware of immunity &Concept related to cells and organs related to immune system
Unit II:Antigen & antibody	To understand meaning of antigen and antibody also types To study various types of antigen antibody reactions	students will be able to know how to diagnose the microbial diseases by using antigen antibody reactions
Unit III:Clinical microbiology	To understand the concept of clinical microbiology To study the different types of clinical samles ,how to collect clinical samples To understand the methods of diagnosis of microbial diseases	students will be able to collect clinical samples & use them for diagnosis of various microbial diseases by using various methods
Unit IV:pathogenecity	To understand the concept of patogenecity	students will be aware of Pathogenicity mechanism
Unit V:Microbial diseases	study some bacterial fungal & viral diseases	students will gain Knowledge and Understanding of some bacterial fungal & viral diseases

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COURSE OUTCOME

Name of Department: - Microbiology

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc.		
NAME OF SUBJECT : Microbiology		
SEM I / II / III / IV / V / VI : Sem IV		
COURSE NUMBER (PAPER NUMBER) : Paper VIII		
TITLE OF COURSE (NAME OF PAPER) :- : : Industrial Microbiology – I		
COURSE CONTENT	OBJECTIVES	OUTCOME
UNIT–I: Industrial Microbiology	To understand the concept of industrial production through the process of fermentation by the involvement of various microorganisms	Students will be able know the concept of industrial microbiology
UNIT –II: Fermentation Media	To learn or know the procedure or sources for the preparation of media are available for the production of various industrial products through fermentation	Students will be able to know the concept of media used for the production of various fermented products
UNIT III: Screening, Inoculum Development and Scale Up	To study or train to the students about screening, Inoculum development and scale up in industrial microbiology	Students will be able to know the concept of Screening, Inoculum Development and scale up
UNIT – IV: Microbiological assays	To study or determine the compound sensitivity towards the microorganisms through microbiological assay	Students will be able to know the concept of Microbiological assay
Unit – V : Specific fermentations	To understand the concept of specific fermentations for different industrial products	Students will be able to know the concept of specific fermentations.

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Name of Department ____ Microbiology ____

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc.

NAME OF SUBJECT : Microbiology

SEM I / II / III / IV / V / VI : Sem V

COURSE NUMBER (PAPER NUMBER) : DSE – 1 - A: Paper MIC IX: Virology

TITLE OF COURSE (NAME OF PAPER) : Virology

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit I: Introduction and Classification of Viruses	To understand the General properties and structure of virus. To aquire knowledge of Viroids and Prions To understand Viral classification on the basis of LHT system and as per international committee	Students will get knowledge of General properties and structure of virus. And also aquire knowledge of Viroids and Prions. Students will come to know the present status and schemes of classification viruses
Unit II: Reproduction of bacterial viruses	To impart the knowledge of productive cycle of T4phage - Lytic cycle and Temperate phages and lysogeny of λ phages	Students will be able to understand the productive cycle of phage reproduction as well as the nonproductive i.e. lysogenic cycle of temperate phages
Unit IV: Plant Viruses	To study Viral plant Diseases - TMV, CaMV Prevention and Control of Plant Viral Disease	students will understand nature of TMV and CaMV and diseases caused by them and prevention and control of plant diseases
Unit V Techniques in Virology	To train the students to Isolation, cultivation,Purification and Enumeration of viruses A. To know One step growth experiment	Students will be able to learn the methods used for cultivation, purification and enumeration of viruses

Name of Department ____Microbiology_____

COURSE OUTCOME

Name of Department ____Microbiology_____

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc		
NAME OF SUBJECT : Microbiology		
SEM I / II / III / IV / V / VI : Sem V		
COURSE NUMBER (PAPER NUMBER) : X		
TITLE OF COURSE (NAME OF PAPER) Agricultural Microbiology		
COURSE CONTENT	OBJECTIVES	OUTCOME
Unit I : Introduction to Soil Microbiology	To understand the soil ,structure, ecosystem and m.orgs in soil and applications of	Students will about the importance of soil in with respect to m.orgs
Unit II: Role of microorganisms in elemental cycle	To aware of various types of elements required by living system and their transformation	Students will apply the theoretical knowledge to study elemental trasformation
Unit III: Composting and Biodegradation	To study various composting methods and role of microorganisms in composting	students can apply knowledge of composting in preparation compost in help to society in solving the problem of solid waste management
Unit IV: Plant pathology	To study the harmful activities like plant diseases caused by organisms , their symptoms, control.	Students will be able to identify plant diseases. And help in control of diseases and make aware the farmers about them.
Unit V Applications of Biotechnology in Agriculture	To study role of various types of microorganisms in biotechnology and agriculture	Students can apply knowledge to get rid of problems in the society

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COURSE OUTCOME

Name of Department ___Microbiology_____

B.A. / **B.Sc.** / M.A. / M.Sc.: **B.Sc.**		
NAME OF SUBJECT : Microbiology		
SEM I / II / III / IV / V / VI : Sem V		
COURSE NUMBER (PAPER NUMBER) DSE-3-A paper MIC-XI		
TITLE OF COURSE (NAME OF PAPER) Immunology		
COURSE CONTENT	COURSE CONTENT	COURSE CONTENT
Unit 1:Immune response	To inculcate knowledge in human immune response towards micro organisms	Students will gain knowledge in human immune response towards micro organisms
Unit II: Major Histocompatibility complex	To study structure and function of MHC	Students will acquire knowledge about structure and function of MHC
Unit III: Complement system	To study properties of complement and activation pathways and its biological effects	Study will understand concept of complement activation pathway and biological effects
Unit IV: Immunological disorders	To study concept of allery types and its pathogenesis To study autoimmunity	Study will understand concept of allery and its pathogenesis, autoimmunity
UnitV:Immunohaematology	To study ABO and Rh blood groups blood transfusion reaction	Students will gain knowledge of ABO and Rh blood groups and blood transfusion nreactions

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COURSE OUTCOME

Name of Department ___Microbiology_____

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc		
NAME OF SUBJECT : Microbiology		
SEM I / II / III / IV / V / VI : Sem V		
COURSE NUMBER (PAPER NUMBER) : SEC – 1 : Paper MIC – XII		
TITLE OF COURSE (NAME OF PAPER) :- Industrial Microbiology – I		
TITLE OF COURSE (NAME OF PAPER) :- Microbial Biochemistry	COURSE CONTENT	COURSE CONTENT
Unit I :-Food Microbiology	To study of various microorganisms in the food substrate and food spoilages., and the concepts of food preservations for long term of food storage and fermented food production	Students will come to know food spoilages, concepts of food preservations for long term of food storage and fermented foods
Unit –II: Dairy Microbiology	To know milk spoilages by microorganisms and production of various fermented dairy products	Students will be able to know microbial action in milk spoilages and production of dairy fermented products
Unit III: Industrial production.	To study various industrial products through fermentation process by desired microorganisms.	Students will be able to know to the production of various fermented products.
Unit – IV: Production of alcoholic beverages	To study of production of alcoholic beverages such as wine and beer and post fermentation of spoilages of wine	Students will be able to know production of wine and beer and concept of wine spoilages
Unit-V:-Downstream processing and quality control	To study or learn the concepts of downstream and quality control processes in fermentation industry	Students will be able know or learn the various downstream and quality control processes in fermentation industry

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COURSE OUTCOME

Name of Department: - Microbiology

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NAME OF SUBJECT : Microbiology		
SEM I / II / III / IV / V / VI : Sem VI		
COURSE NUMBER (PAPER NUMBER) : DSE – 2 – B: Paper MIC - XI		
TITLE OF COURSE (NAME OF PAPER) :- Microbial Biochemistry		
COURSE CONTENT	OBJECTIVES	OUTCOME
Unit I :- Enzyme, Enzyme kinetics and regulatio	To obtain a general knowledge about how enzymes work To study of enzyme kinetics and its regulations in biochemical reactions	Students will be able to know or learn the concepts of enzymes, enzyme kinetics and regulation of enzymes in biochemical reactions
Unit –II: Extraction, purification and assay of enzymes	To study of extraction processes of enzyme and understand the quality of enzyme through purification and assay	Students will be able to know extraction processes, purification and assay of enzymes
Unit III: Assimilation of: Carbon, Nitrogen and Sulphurssss	To study the metabolic reactions of microorganisms for assimilation of carbon, nitrogen and sulphur	Students will be able to know the concepts of metabolic reactions of microorganisms.
Unit – IV: Bioenergetics	To study how living organisms acquire and transform energy in order to perform biological work and metabolic pathways	Students will be able to know or learn the concepts of bioenergetics and metabolic pathways.
Unit-V:- Biosynthesis of: Nucleotides, Protein and Peptidoglycan	To study or learn the concepts of biosynthesis of Nucleotides, Protein and Peptidoglycan	Students will be able know or learn the concepts of biosynthesis

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COURSE OUTCOME

Name of Department ____Microbiology_____

B.A. / B.Sc. / M.A. / M.Sc. : B.Sc
NAME OF SUBJECT : Microbiology
SEM I / II / III / IV / V / VI : Sem V
COURSE NUMBER (PAPER NUMBER) : XV
TITLE OF COURSE (NAME OF PAPER) Environmental Microbiology

COURSE CONTENT	OBJECTIVES	OUTCOME
Unit I : Air microbiology	To understand the environment , microorganisms in air , its pollution and its control.	Students will know about microorganisms in air , their role and pollution studies
Unit II: Marine microbiology and Fresh water ecosystem	To aware about study of Water ecosystem To provide an intensive and in depth learning about various Fresh & marine water bodies	Students will apply the theoretical knowledge to study water ecosystem and apply various methods to control pollution
Unit III: Extremophiles	To study various extremophilic organisms , characters and their role	students will get more knowledge about diversity of microflora in the extreme environments.
Unit IV: Environmental impact assessment and Industrial Waste Management	To understand the effects of pollutants from industrial wastes on water bodies to the students.	Students will be able to think about impact of waste water and apply the knowledge in removal of pollution awarded of pollution control
Unit V Geomicrobiology	To study various techniques for extraction of metals and oil recovery from low grade ores oil wells respectively	Students may enriched with knowledge of various aspects environmental microorganisms.

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COURSE OUTCOME

Name of Department ___Microbiology_____

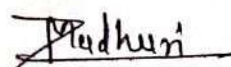| B.A. / **B.Sc.** / M.A. / M.Sc.: **B.Sc.**		
NAME OF SUBJECT : Microbiology		
SEM I / II / III / IV / V / VI VI		
COURSE NUMBER (PAPER NUMBER) DSE-3-paper MIC-XVI		
TITLE OF COURSE (NAME OF PAPER) Clinical microbiology-I		
COURSE CONTENT	OBJECTIVES	OUTCOME
Unit I:Clinical bacteriology	To inculcate knowledge in relationship between human disease and bacterial pathogens, their pathogenicity, laboratory diagnosis and treatment methods	Students will acquire knowledge aboutetiology,epidemiology,pathogene city laboratory diagnosis,prophylaxis of bacterial diseases
Unit II: Clinical mycology	To inculcate knowledge in relationship between human disease and fungal pathogens, their pathogenicity, laboratory diagnosis and treatment methods	Students will acquire knowledge aboutetiology,epidemiology,pathogene city laboratory diagnosis,prophylaxis of fungal diseases
Unit III: Clinical parasitology	To inculcate knowledge in relationship between human disease and protozoal pathogens, their pathogenicity, laboratory diagnosis and treatment methods	Students will acquire knowledge aboutetiology,epidemiology,pathogene city laboratory diagnosis,prophylaxis of protozoal diseases
Unit IV: Clinical virology	To inculcate knowledge in relationship between human disease and viral pathogens, their pathogenicity , laboratory diagnosis and treatment methods	Students will acquire knowledge aboutetiology,epidemiology,pathogene city laboratory diagnosis,prophylaxis of viral diseases
Unit V:chemotherapy	To study drugs antibiotics their mechanism of action,drug resistance	Students will gain the knowledge of drugs antibiotics their mechanism of action and drug resistance

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Department of Zoology
B Sc. ZOOLOGY
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Programme Outcome.

- This program is the fundamental unit of basic sciences studied at Graduate level.
- Understanding about the fundamental concepts, principles and processes underlying the academic field of Zoology and its different subfields (animal diversity, principles of ecology, comparative anatomy and developmental biology of vertebrates, physiology and biochemistry, genetics and evolutionary biology, animal biotechnology, applied Zoology, aquatic biology, immunology, reproductive biology, and insect, vectors and diseases, apiculture, aquarium fish keeping, medical diagnostics, and sericulture) (ii) procedural knowledge that creates different types of professionals in the field of Zoology and related fields such as, apiculture, medical diagnostics, and sericulture, etc.(iii) skills related to specialization areas within Zoology as well as within subfields of Zoology, including broader interdisciplinary subfields (Chemistry, bio-Physics and Mathematics).
- Students gain knowledge and skill in the fundamentals of animal sciences, understands the complex interactions among various living organisms
- The courses should be delivered in terms of concepts, mechanisms, biological designs & functions and evolutionary significance cutting across organisms at B.Sc. level. These courses should be studied by students of all branches of biology.
- Both chalk and board, and PowerPoint presentations can be used for teaching the course.
- The students should do the dissertation/ project work under practical of different courses, wherever possible.
- Analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment
- Apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms.
- Apply the knowledge and understanding of Zoology to one's own life and work.
- Develops empathy and love towards the animals.
- The program helps to develop scientific tempers and attitudes, which in turn canprove to be beneficial for the society since the scientific developments can makea nation or society to grow at a rapid pace.
- This will provide them ample opportunities to explore different career avenues.
- The program will also provide a platform for classical genetics in order tounderstand distribution or inheritance of different traits.
- Science graduates can go to serve in industries or may opt for establishingtheir own industrial unit.
- Practical and theoretical skills gained in this program will be helpful in designingdifferent public health strategies for social welfare.
- They should be able to appreciate shifting their orientation of learning from a descriptive explanation of biology to a unique style of learning through graphic designs and quantitative parameters to realize how contributions from research and innovation have made the subjects modern, and applied and laid the foundations of Zoology. Animal Sciences, Life Sciences, Molecular Biology and Biotechnology.

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Head of the Department
Zoology

- These courses and their practical exercises will help the students to apply their knowledge in future course of their career development in higher education and research.
- In addition, they may get interested to look for engagements in industry and commercial activities employing Life Sciences, Molecular Biology and Biotechnology.
- The program has been designed to provide in-depth knowledge of appliedsubjects ensuring the inculcation of employment skills so that students can achieve a career and become an entrepreneur in diverse fields.
- After Undergraduate, students can get admission to M.Sc. Zoology. M.Sc.. Environmental Science. M.Sc., Biotechnology etc.
- The successful students will be able to establish research organizations with the help of agriculture, environment protection and also their own industry for transgenic animals, clinical pathology, genetic counseling, human karyotyping etc. Scientific Research Organizations. Universities in India & aboard.
- Contributes the knowledge for Nation building.

Course Outcome :

B.Sc. I .Sem- I	
PAPER I: Animal Diversity- I Theory and Practical	- Provides students with an in-depthknowledge of the diversity in form, structure and habits of invertebrate - Learn basics of systematics and understand hierarchy of different categories - Obtain overview of economically important invertebrates. - Classify all the invertebrate phyla up to class. - Develop understanding in the diversity of the life in regards to protists and Non chordates - Group the animals on the basis of morphologicalstructures - Develop critical understanding about evolution of animals and acquire knowledge of both living and extinct animals Paper
PAPER II Animal diversity-II Theory and Practical	- Provides students with an in-depth knowledge of the diversity in form, structure and habits of vertebrates - Learn general characters and classification of different classes of vertebrates. - Understand the vertebrate evolutionary tree. Obtain overview of economically important vertebrates.
B.Sc I .Sem- II	

PAPER III Comparative Anatomy of vertebrates Theory and Practical	• This course provides students with the basic knowledge in vertebrate anatomy and biology from both functional and evolutionary points of view. • Students also gain knowledge about fundamental steps in vertebrate development from fertilization to organogenesis. • The students will be able to describe the vertebrate structures and relate morphology, function and evolution.
PAPER- IV Developmental Biology of vertebrates Theory and Practical	• Be able to list the types of characteristics that make an organism ideal for the study of developmental biology. • Know the broad phylogenetic relationships of animal phyla. • Be able to describe the stages and cellular mechanisms like invagination, of gastrulation in the frog and chick . Be able to describe the functions of gastrulation. • Be able to describe in general terms how vertebrates gastrulate (frog. fish. chick, and mammal). • Be able to label macromeres, mesomeres, and micromeres and know which cell types are derived from each of these cell layers in the early embryo (e.g. primary and secondary mesenchyme, ectoderm, endoderm, mesoderm).

B.Sc. II (Sem–III& IV)
CHOICE BASED CREDIT SYSTEM Syllabus: ZOOLOGY

B.Sc. II.Sem–III Paper- V Cell Biology Theory and Practical	• Cellular architecture & their functions at organismic level. • This knowledge will help students in future to explore areas like: oncology, medical diagnostics Sand Treatment Understand the functioning of nucleus and extra nuclear organelles and understand the intricatecellular mechanisms involved. • Acquire the detailed knowledge of different pathways related to cell signaling and apoptosisthus enabling

	them to understand the anomalies in cancer.
	• Develop an understanding how cells work in healthy and diseased states and to give a 'healthforecast' by analyzing the genetic database and cell information.
	• Get new avenues of joining research in areas such as genetic engineering of cells, cloning, vaccines development, human fertility programme, organ transplant, etc.
Paper –VI Principles of Ecology Theory and Practical	• Ecological principles & applications that govern the planet Earth • This knowledge will help students in future to explore areas like: biodiversity, conservation biology, forestry & natural resource management. • Know the evolutionary and functional basis of animal ecology. • Understand what makes the scientific study of animal ecology a crucial and exciting endeavor. • Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field. • Analyze a biological problem, derive testable hypotheses and then design experiments and put the tests into practice. • Solve the environmental problems involving interaction of humans and natural systems at local or global level.
B.Sc. II.Sem–IV	•
PAPER-VII: Fundamentals of Biochemistry Theory and Practical	• Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids. • Understand the structure and function of immunoglobulins. Understand the concept of enzyme. its mechanism of action and regulation. • Understand the process of DNA replication, transcription and translation.

	• Learn the preparation of models of peptides and nucleotides. • Learn biochemical tests for amino acids, carbohydrates, proteins and nucleic acids. • Learn measurement of enzyme activity and its kinetics.
PAPER-VIII Animal Physiology: Controlling and Coordinating Systems Theory and Practical	• Acquire knowledge of the coordinatedphysiological functioning • Realize that very physiological mechanisms are used in very diverse organisms. • Understand how cells, tissues, and organisms function at different levels. • Develop an understanding of the related disciplines, such as cell biology, neurophysiology, pharmacology, biochemistry etc Get a flavor of research by working on project besides improving their writing skills. • It will further enable the students to think and interpret individually. • Undertake research in any aspect of animal physiology in future.

Prudhun

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