

# Syllabus Book

1<sup>st</sup> to 6<sup>th</sup> Semester

B. Sc. Biotechnology



**P P Savani University**

School of Sciences

Academic Session: 2022-23

Authored by: P P Savani University

**P P Savani University**  
**School of Sciences**  
Syllabus, Teaching and Examination Scheme

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**Sem-1**

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**Course Name:** Introduction to Biotechnology I

**Course Code:** SSBT1010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To impart knowledge of classification of Plant and Animal kingdom, viruses and their life cycle, and the basics of Biotechnology.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	Plant-Introduction and outline classification of angiosperms, Gymnosperms, Pteridophytes, Bryophytes	07	25
2	Animal- Introduction and outline classification non-chordates (Prolifera to Echinodermates) and chordates	10	30
Section-II			
3	Viruses- Structure and Classification, Virions, Prions	06	20
4	Biotechnology: definitions, an interdisciplinary pursuit. Traditional and Modern Biotechnology, Three central core components of Biotechnology Product safety, Public perception of Biotechnology, Scope of Biotechnology, Definition of genetic engineering & Cloning	07	25

**Course outcome:**

**CO-1:** To gain knowledge about the characteristics of angiosperms, gymnosperms, pteridophytes, etc.

**CO-2:** To gain knowledge about important characters of the animal kingdom

**CO-3:** To gain knowledge about structures, classification and mechanism of propagation of viruses

**CO-4:** To gain knowledge about multidisciplinary nature of Biotechnology its emerging fields

**Reference Books:**

Title	Authors	Publisher
Elements of Biotechnology	P.K Gupta	Rastogi
Basic Biotechnology	Ratledge C & Kristiansen B	Cambridge University Press
Biotechnology: Expanding Horizon	B.D Singh	Kalyani publishers
Microbiology	Prescott	McGraw-Hill
Zoology for Degree Students	V K Agarwal	S Chand



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 Syllabus, Teaching and Examination Scheme

**Course Name:** Introduction to Biotechnology II

**Course Code:** SSBT1020

**Prerequisite:** Nil

Teaching and Examination Scheme:						
Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to have exposure of students to scopes and allied domains of the subject, recent important landmarks in the field of transgenic animals and plants, role of microbes in the industries for various products and information on Governing bodies of biotechnology and their organizations in India

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	Transgenics, Fundamentals of Plant Biotechnology: Transgenic plants (GM Papaya, GM Tomato), Biotic and abiotic Resistant Plants developed, BT Cotton, golden rice and BT Brinjal Pros and Cons	09	30
2	Fundamentals of Animal Biotechnology: Transgenic animals and Livestock Improvements, Dolly sheep, Stem cell research	06	20
Section-II			
3	Fundamentals of Microbial Biotechnology: Industrial Important microbes and derived products.	06	20
4	Biotechnology Research in India. Biotechnology Institutions in India (Public and Private Sector), Biotech Success Stories Biotech Policy Initiatives Biotechnology in context of Developing World, Introduction to DBT, Autonomous institutions of DBT, Public sector undertaking of DBT, BITS-NET, Introduction to ABLE	09	30

**Course outcome:**

**CO-1:** To acquire knowledge about Plant Biotechnology and their application

**CO-2:** To acquire knowledge about techniques applied for developing transgenic plants and animals.

**CO-3:** Learn to identify industrially important microbial strains, their maintenance, preservation techniques, and processing to get the product

**CO-4:** To acquire knowledge about role of biotechnology in our everyday life, and the govt. regulatory bodies and their schemes for the upliftment of society in India

**Reference Books:**

Title	Authors	Publisher
Elements of Biotechnology	P.K Gupta	Rastogi
Basic Biotechnology	Ratledge C & Kristiansen B	CambridgeUniversityPress
Biotechnology: Expanding Horizon	B.D Singh	Kalyani publishers
Microbiology	Prescott	McGraw-Hill
Zoology for Degree Students	V K Agarwal	S Chand

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**Course Name:** Biotechnology Practical

**Course Code:** SSBT1030

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To make aware of different instruments and techniques used in Biotechnology, sterilization methods for glassware and culture media and proper disposal of biowastes

**Course Contents:**

Section-I		
Module	Content	Hours
1	Principle working & uses of following laboratory instruments: Microscope, Incubator, pH meter,	8
2	Principle working & uses of following laboratory instruments: Colony counter, Autoclave, Weighing balance, Laminar Air Flow (LAF) chamber	8
3	Principle working & uses of following laboratory instruments: Hot air oven, Inspissator and UV-VIS Spectrophotometer	6
3	Centrifugation including ultra-centrifugation	6
4	Preparation & sterilization of Glassware using Autoclave	5
5	Preparation & sterilization culture media	5
6	Methods of disposing the culture media, cultures and laboratory waste materials	5
7	A visit to nearby Industry	8
8	A visit to nearby Scientific laboratory	8

**Course outcome:**

**CO-1:** Learn about the principle, working and applications of commonly used instruments in Biotechnology

**CO-2:** To acquire knowledge about handling, calibration and use of various instruments

**CO-3:** To acquire knowledge about techniques used in Plant Biotechnology

**CO-4:** Learn to safe disposal of culture media, laboratory waste material

**Reference Books:**

Title	Authors	Publisher
Elements of Biotechnology	P.K Gupta	Rastogi
Basic Biotechnology	Ratledge C & Kristiansen B	CambridgeUniversityPress
Biotechnology: Expanding Horizon	B.D Singh	Kalyani publishers
Microbiology	Prescott	McGraw-Hill
Zoology for Degree Students	V K Agarwal	S Chand

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 Syllabus, Teaching and Examination Scheme

**Course Name:** Introduction to Microbiology I

**Course Code:** SSMB1010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed with the detailed information on the history and scope of microbiology and the basics of different fields in microbiology, types of microbes, morphological types, diversity, and economical importance of algae and fungi

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	History and scope of Microbiology, Introduction to microorganisms, Discovery, Types of microbes, Golden period of microbiology, Scope and future of microbiology	09	30
2	Bacterial Diversity: General characteristics of Bacteria, Achaea, Cyanobacteria. Classification and economic importance	06	20
Section-II			
3	Fungal Diversity: General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra- structure, thallus organization and aggregation, Classification and Economic and importance of fungi	06	20
4	Algal Diversity: General characteristics of algae including occurrence, thallus organization, algae cell ultra-structure, Classification and Economic importance of algae	09	30

**Course outcome:**

**CO-1:** To learn about the various field of microbiology and its future scope

**CO-2:** To acquire knowledge about the morphology, characteristics of bacteria, and their significance

**CO-3:** To acquire knowledge about the morphology, characteristics of fungi, and their significance

**CO-4:** To gain knowledge about the morphology, characteristics of algae, and their significance

**Reference Books:**

Title	Authors	Publisher
Microbiology	Prescott	McGraw-Hill
Microbiology	Pelczar	Tata McGraw-Hill
General Microbiology	StanierRY, Ingraham JL, Wheelis ML, and Painter PR	5 <sup>th</sup> edition. McMillan (2005)
Experiments in Microbiology, Plant Pathology and Biotechnology	Aneja	New Age Publisher
Microbiology Introduction	Tortora Gerad	Benjamin Cumming



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**Course Name:** Introduction to Microbiology II

**Course Code:** SSMB1020

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed with detailed information about the different classification and nomenclature systems for microbes, external features, and structures of microbes, important internal structures of microbes including bacteria, and identification of different microbes by suitable microscopic techniques.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	Microbial Classification, Systems of classification: Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility, Bacterial systematics	09	30
2	Major cell Morphologies, Morphology and Biology, Cell size and significance of smallness, Significance of surface to volume ratio, Lower limits of cell size.	06	20
Section-II			
3	Bacterial cell surface appendages, Pili, Fimbriae, Cell inclusions, Gas Vesicles, Endospores, Nucleoid, Chemotaxis, Structures responsible for motility in bacteria, Types of motility	09	30
4	Concept of Microscopy-resolution, simple and compound microscopy, various types of microscopy	06	20

**Course outcome:**

**CO-1:** To acquire knowledge about basics of the Microbial classification.

**CO-2:** To acquire knowledge about the morphology of microbes

**CO-3:** To learn how to differentiate microbes based on their external/ internal structures

**CO-4:** To acquire knowledge about different microscopic techniques for the identification of microbes

**Reference Books:**

Title	Authors	Publisher
Microbiology	Prescott	McGraw-Hill
Microbiology	Peleczar	Tata McGraw-Hill
General Microbiology	Stanier RY, Ingraham JL, Wheelis ML, and Painter PR	5 <sup>th</sup> edition. McMillan (2005)
Experiments in Microbiology, Plant Pathology and Biotechnology	Aneja	New Age Publisher
Microbiology Introduction	Tortora Gerad	Benjamin Cumming

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**Course Name:** Microbiology Practical

**Course Code:** SSMB1030

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To understand basic and routine lab practical's of microbiology such that preparation of media for microbes, isolation of microbes from air, water, and soil. To make aware of the basic instruments which are routinely used in a microbiology laboratory and identification of different microbes by suitable microscopic techniques.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Introduction to Microbiology Good Laboratory Practices and Biosafety	6
2	To study the principle and applications of important instruments: Biological safety cabinets, autoclave, incubator, BOD incubator	6
3	To study the principle and applications of important instruments: Hot air oven, light microscope, pH meter) used in the Microbiology laboratory	6
4	Sterilization of glassware, medium using autoclave and assessment for sterility	6
5	Sterilization of heat sensitive material by membrane filtration and assessment for sterility	6
6	Preparation of Nutrient broth an Nutrient agar medium	6
7	Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air	6
8	Microscopic observation of morphological characteristics of Protozoa/Yeast using compound microscope	6
9	Study of bacterial motility by hanging drop techniques	6
10	Preparation of culture media for microbes (bacteria, fungal, algal cultivation)	6

**Course outcome:**

**CO-1:** To acquire knowledge about media preparation for growing microbial culture

**CO-2:** To learn skills for isolation of microbes independently from various samples

**CO-3:** To acquire basic skills to operate various microbiological laboratory instruments

**CO-4:** To learn basic microbiological techniques

**Reference Books:**

Title	Authors	Publisher
Microbiology	Prescott	McGraw-Hill
Microbiology	Peleczar	Tata McGraw-Hill
General Microbiology	StanierRY, Ingraham JL, Wheelis ML, and Painter PR	5 <sup>th</sup> edition. McMillan (2005)
Experiments in Microbiology, Plant Pathology and Biotechnology	Aneja	New Age Publisher
Microbiology Introduction	TortoraGerad	Benjamin Cumming

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**Course Name:** Introduction to Environment Science I

**Course Code:** SSES1010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to create and disseminate knowledge to the students about environmental problems at a local, regional and global scale, to understand the natural resources and their significance, learn about the different ecosystems, and science of biodiversity in an ecological context

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	Multidisciplinary nature of environmental studies a) Definition, scope and importance b) Need for public awareness.	06	20
2	Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources; Water resources; Mineral resources; Food resources; Energy resources; Land resources	09	30
Section-II			
3	Ecosystems a) Concept of anecosystem. b) Structure and function of anecosystem. c) Producers, consumersanddecomposers. d) Energy flow in theecosystem. e) Ecologicalsuccession. f) Food chains, food webs and ecologicalpyramids	09	30
4	Biodiversity and its conservation Introduction - Definition: genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. a) Indian Biodiversity & its importance (Hots Spots) b) Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlifeconflicts. c) Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	06	20

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	d) Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.		
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**Course outcome:**

- CO-1:** To acquire knowledge of different aspects of local, regional, and global environmental problems.  
**CO-2:** To understanding the sustainable usage and maintenance of natural resources  
**CO-3:** To acquire knowledge about different ecosystems, food web, food chain, and ecological pyramids  
**CO-4:** To acquire knowledge about basic concepts of biodiversity and its conservation

**Reference Books:**

Title	Authors	Publisher
The Biodiversity of India,	Bharucha Erach,	Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India
Environmental Biology,	Agarwal, K.C.	Nidi Publ. Ltd. Bikaner.
Fundamentals of Ecology.	Odum, E.P.	W.B. Saunders Co. USA, 574p
Essentials of Physical Chemistry	A.Bahl, B.S. Bahl and G.D. Tuli	S. Chand Publishing
Textbook of Engineering Chemistry (4 <sup>th</sup> Edition)	R. Gopalan, D. Venkappaya, S. Nagarajan	Vikas Publishing house Ltd.
Concise Inorganic Chemistry	J.D. Lee	Wiley India
Engineering Chemistry (16 <sup>th</sup> Edition)	P.C. Jain and Monika Jain	DhanpatRai publishing company

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**Course Name:** Chemistry I

**Course Code:** SSES1020

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to acquire knowledge about chemistry fundamentals, enriching students to understand the role of Environment & Chemistry in the field of science.

To inculcate habit of scientific reasoning to do the task rationally.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Structure of Atom:</b> Atom, sub-atomic particles, Rutherford's atomic model, Mosley's determination of atomic number, Electromagnetic spectrum, Continuous spectrum, Atomic spectra, Atomic spectrum of hydrogen, Quantum theory of radiation, Explanation to Photoelectric effect, Compton effect, Bohr's model of atom, Zeeman effect.	06	20
2	<b>Chemical Bonding and Structure of Molecules:</b> <b>General terms:</b> Chemical bond, valence, valence electrons, Bonding and Nonbonding electrons, Lewis symbols, Octet rule. <b>Ionic bond:</b> Definition, Condition for formation of ionic bond, Factors governing formation of ionic bond, Characteristics of ionic compounds. <b>Covalent bond:</b> Definition, conditions for covalent bond formation, examples, General characteristics of covalent compounds, valence bond approach, Concept of hybridization, Hybridization and shape of molecules, Limitations of Valence bond theory, VSEPR theory. <b>Hydrogen bonding:</b> Definition, conditions for H-bond formation, examples, Types of H-bonds, Characteristics of H-bonded compounds. <b>Metallic bond:</b> Definition, The Electron sea model	09	30
Section-II			
3	<b>Acid and Bases:</b> Basic properties of acids and bases, Arrhenius concept, Lowry Bronsted Concept, Lewis concept of acids and bases, Derive equation for relative strength of strong acids and bases, Calculate the relative	09	30

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	strength of weak acids and bases, pH of solutions, measurement of pH, pH scale, common ion effect, Buffer solutions, Discuss how the addition of a small amount of acids or bases not affects the pH of buffer solutions, derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the humanbody. Numerical Problems.		
4	<b>Colloids</b> Lyophilic and lyophobic sols, Characteristics of lyophilic and lyophobic sols, preparation of sols, Purification of sols, Dialysis, Properties of sols, stability of sols, coagulation or flocculation of colloids, gold number, zeta potential, application of colloids.	06	20

**Course outcome:**

**CO-1:** To acquire fundamental knowledge of atoms, Quantum theory, and Photoelectric effect

**CO-2:** To acquire basic knowledge of chemical structures and bonds

**CO-3:** To acquire basic knowledge about acid and bases

**CO-4:** To know about the properties of colloids

**Reference Books:**

Title	Authors	Publisher
Essentials of Physical Chemistry	A.Bahl, B.S. Bahl and G.D. Tuli	S. Chand Publishing
Textbook of Engineering Chemistry (4 <sup>th</sup> Edition)	R. Gopalan, D. Venkappaya, S. Nagarajan	Vikas Publishing house Ltd.
Concise Inorganic Chemistry	J.D. Lee	Wiley India
Engineering Chemistry (16 <sup>th</sup> Edition)	P.C. Jain and Monika Jain	DhanpatRai publishing company



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**Course Name:** Environment & Chemistry Practical I

**Course Code:** SSES1030

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To learn about solutions, water sample testing, and using chemistry equipment and enhance the knowledge about biodiversity.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Water & wastewater quality assessment experiment.	6
2	Analysis of salts/ions present in hard & soft water	6
3	Visit to Local Polluted Site -Observations and Remedial Measures	6
4	Visit to in situ or ex situ Conservation Centre/ Social Service Organization/ Environmental Education Centre	12
Chemistry Practical		
1.	Introduction to chemistry laboratory – Equipment, common laboratory glasswares and their uses. General awareness on handling of chemicals and waste disposal in laboratory, fire hazards, eye protection, contact and ingestion hazard.	6
2.	Prepare 0.1N NaOH solution and standardize it by given oxalic acid solution.	6
3.	Determination of dissociation constant of strong acid by pH metric method	6
4.	Surface tension measurements of different solvents by stalagmometer	6
5.	Determine the precipitation values for arsenious sulphide sol	6

**Course outcome:**

**CO-1:** To acquired fundamental knowledge of solutions and their preparation

**CO-2:** To learn basic knowledge of liquid state with various forces, and characterization of physical properties

**CO-3:** To learn how to operate chemistry lab equipments like, pH meter, stalagmometer etc.

**CO-4:** To learn water suitability testing for drinking and household usages

**Reference Books:**

Title	Authors	Publisher
Textbook of Engineering Chemistry (4 <sup>th</sup> Edition)	R. Gopalan, D. Venkappaya, S. Nagarajan	Vikas Publishing HouseLtd.
Concise Inorganic Chemistry	J.D. Lee	Wiley India
Engineering Chemistry (16 <sup>th</sup> Edition)	P.C. Jain and Monika Jain	DhanpatRai publishing Company

**Sem-2**

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**Course Name:** Cell Biology I

**Course Code:** SSBT1040

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed with the detailed information on the cell theory, classes of cells, structure and function of certain cell organelles.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	Discovery of cells, Basic properties of cells, Fundamental classes of cells: Prokaryotic (Bacterial cell, Archaeal cell), Eukaryotic cells (Plant and Animal), Viruses	06	20
2	Structure and various models of biological membranes, Organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport.	09	30
Section-II			
3	Structure, composition and functions of: a) Membrane Vacuolar system, and cytoskeleton b) Endoplasmic reticulum c) Golgi complex	09	30
4	Structure, composition and functions of: a) Lysosomes b) Ribosomes c) Mitochondria d) Chloroplasts e) Nucleus	06	20

**Course outcome:**

**CO-1:** To learn about fundamental knowledge of cells and their basic properties

**CO-2:** To acquire basic knowledge about the structure and function of cell wall/plasma membrane

**CO-3:** To gain knowledge about the structure, composition and function of cell organelles

**CO-4:** To gain knowledge about the structure, composition and function of nucleus, mitochondria, ribosome and chloroplast

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**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Cell and Molecular Biology: Concepts and Experiments.	Karp, G. 2010.	6 <sup>th</sup> Edition. John Wiley & Sons. Inc.
Cell and Molecular Biology.	De Robertis, E.D.P. and De Robertis, E.M.F. 2006.	8 <sup>th</sup> edition. Lippincott Williams and Wilkins, Philadelphia
Cell Biology	Bhatia KN	Trueman
The Cell: A Molecular Approach	Geoffrey M. Cooper, Robert E. Hausman	Sinauer

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**Course Name:** Cell Biology II

**Course Code:** SSBT1050

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed with detailed information about the cell cycle, cell division (mitosis, meiosis) and study of cancer (Oncology).

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	The Cell cycle and its Regulation via various Checkpoints	09	30
2	Mitosis: cell division of somatic cell, Various Phases (Prophase, Prometaphase, Metaphase, Anaphase, Telophase), Forces required for Mitotic Movements, Cytokinesis	06	25
Section-II			
3	Meiosis: cell division of gametic cell, Various Phases in Meiosis I and Meiosis II, Genetic recombination during Meiosis	09	30
4	Oncology: study of Cancer, types and molecular basis of cancer, Programmed cell death(PCD)	06	25

**Course outcome:**

**CO-1:** To learn about the cell cycle and its regulations.

**CO-2:** To acquire knowledge about cell division of somatic cells.

**CO-3:** To acquire knowledge about cell division of gametic cells.

**CO-4:** To acquire knowledge about cancer and apoptosis.

**Reference Books:**

Title	Authors	Publisher
Cell and Molecular Biology: Concepts and Experiments.	Karp, G. 2010.	6 <sup>th</sup> Edition. John Wiley & Sons. Inc.
Cell and Molecular Biology.	De Robertis, E.D.P. and De Robertis, E.M.F. 2006.	8 <sup>th</sup> edition. Lippincott Williams and Wilkins, Philadelphia
Cell Biology	Bhatia KN	Trueman
The Cell: A Molecular Approach	Geoffrey M. Cooper, Robert E. Hausman	Sinauer

**P P Savani University**  
**School of Sciences**  
 Syllabus, Teaching and Examination Scheme

**Course Name:** Cell Biology Practical

**Course Code:** SSBT1060

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To learn the structure of cells, their fundamental processes, gain knowledge of the cell cycle and cell division, and estimate biomolecules

**Course Contents:**

Section-I		
Module	Content	Hours
1	Study of structure of Prokaryotic and Eukaryotic cells	10
2	To study osmosis	6
3	Demonstration of dialysis	6
4	To study of plasmolysis and de-plasmolysis	6
5	To study various Cell division stages in onion root tip	8
6	Estimation of reducing sugar by Cole's method	6
7	Protein estimation by Folin-lowry's method	6
8	Quantitative estimation of aminoacids by Ninhydrin method	6
9	Microscopic observation of Drosophila compound eyes	6

**Course outcome:**

**CO-1:** To learn difference between prokaryotic and eukaryotic cells.

**CO-2:** To learn basic processes like diffusion, osmosis, dialysis, and plasmolysis.

**CO-3:** To acquire knowledge about different cellular events that happens during cell division.

**CO-4:** To learn the estimation of reducing sugar, protein, and amino acids through different methods

**Reference Books:**

Title	Authors	Publisher
Cell and Molecular Biology: Concepts and Experiments.	Karp, G. 2010.	6 <sup>th</sup> Edition. John Wiley & Sons. Inc.
Cell and Molecular Biology.	De Robertis, E.D.P. and De Robertis, E.M.F. 2006.	8 <sup>th</sup> edition. Lippincott Williams and Wilkins, Philadelphia
Cell Biology	Bhatia KN	Trueman
The Cell: A Molecular Approach	Geoffrey M. Cooper, Robert E. Hausman	Sinauer



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 Syllabus, Teaching and Examination Scheme

**Course Name:** Fundamentals of Bacteriology I

**Course Code:** SSMB1040

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

This course is designed to learn about the basics of microbial nutrition and its need, culture media, familiarize students with types of microbes based on their energy source, carbon source, an electron source, different bacteriological techniques, isolation, enumeration, maintenance, and preservation of microorganisms

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	Nutritional Requirement of Bacteria, Needs of Carbon, Hydrogen, oxygen, Electrons, Nitrogen, Phosphorus, Sulfur	09	30
2	Types of microbes based on nutritional requirement, Growth factors, The nutrition cycles	06	20
Section-II			
3	Bacteriological techniques, Pure culture isolation: Streaking plate, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures	06	20
4	Concept and Types of Culture media: Chemical, Physical & Biological, Cultivation of anaerobic and aerobic bacteria	09	30

**Course outcome:**

**CO-1:** To understand major and minor nutrients required for the bacterial growth.

**CO-2:** To learn about different types of microbes based on nutritional requirement.

**CO-3:** To acquire knowledge regarding plating techniques, culture isolation, and how to store and preserve isolated pure culture.

**CO-4:** To acquire knowledge about specific culture media used to grow microbes in different conditions.

**Reference Books:**

Title	Authors	Publisher
Microbiology	Prescott	McGraw-Hill
Microbiology	Pelczar	Tata McGraw-Hill
Experimental Microbiology	Rakesh Patel	AdityaPrakashan
Experiments in Microbiology, Plant Pathology and Biotechnology	Aneja	New Age Publisher

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**Course Name:** Fundamentals of Bacteriology II

**Course Code:** SSMB1050

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To learn about bacterial growth patterns, and cell cycle, learn about the techniques and instruments for measuring the growth of microbes, the effect of various external parameters affecting the growth of microbes, and information about the important biological macromolecules present

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	Bacterial Cell cycle, Growth curve, Techniques for Bacterial Growth Measurement	06	20
2	Batch and continuous culture of micro-organisms (Chemostat and Turbidostat), Microbial Growth in natural environments, Bio-films	09	30
Section-II			
3	Influence of Environment on Microbial growth (Solutes and wateractivity, pH, Temperature, Oxygen concentration, Pressure, Radiation)	06	20
4	Introduction to various biological macromolecules: carbohydrates, lipids, proteins and nucleic acids	09	30

**Course outcome:**

**CO-1:** To learn about the bacterial cell cycle and growth curve.

**CO-2:** To acquire knowledge about measuring the microbial population by batch, continuous culture.

**CO-3:** To learn about the effect of the external environment on the microbes.

**CO-4:** To learn about the nature and structure of biological biomolecules.

**Reference Books:**

Title	Authors	Publisher
Microbiology	Prescott	McGraw-Hill
Microbiology	Pelczar	Tata McGraw-Hill
Experimental Microbiology	Rakesh Patel	AdityaPrakashan
Experiments in Microbiology, Plant Pathology and Biotechnology	Aneja	New Age Publisher

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**Course Name:** Bacteriology Practical

**Course Code:** SSMB1060

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To learn about bacterial growth kinetics, staining procedure, cultivation using certain plate and culture method

**Course Contents:**

Section-I		
Module	Content	Hours
1	Preparation of different media: Synthetic media & Complex media	6
2	Cultivation of bacteria using Broth culture	6
3	Cultivation of bacteria using Slant-culture	6
4	Cultivation of bacteria using Stab-culture	6
5	Enumeration of CFU by spread plate method	6
6	Enumeration of CFU by pour plate method	6
7	Isolation of pure cultures of bacteria	6
8	Gram Staining: principle & procedure	6
9	Preservation of bacterial cultures by various techniques	6
10	Motility by hanging drop method	6

**Course outcome:**

**CO-1:** To acquire knowledge about of various culture media preparation.

**CO-2:** To acquire knowledge about cultivation of bacteria using different culture techniques.

**CO-3:** To learn about the enumeration of CFU by various plating methods and how to prepare pure culture of bacteria.

**CO-4:** To learn about the various microbial techniques like, Gram staining, hanging drop method for mobility testing.

**Reference Books:**

Title	Authors	Publisher
Microbiology	Prescott	McGraw-Hill
Microbiology	Pelczar	Tata McGraw-Hill
Experimental Microbiology	Rakesh Patel	AdityaPrakashan
Experiments in Microbiology, Plant Pathology and Biotechnology	Aneja	New Age Publisher

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**Course Name:** Introduction to Environment Science II

**Course Code:** SSES1040

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To gain knowledge of different types of pollution, its cause and effects, using resource to develop a sustainable environment, and to know about what protective actions are made to prevent our environment and about population control and its ultimate benefits to the environment.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Environmental Pollution:</b> Definition, Cause, effects and control measures of: - a) Air pollution b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards	09	30
2	<b>Social Issues and the Environment</b> a) From Unsustainable to Sustainable development b) Urban problems related to energy c) Water conservation, rainwater harvesting, watershed management d) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.	06	20
Section-II			
3	a) Environment Protection Act. b) Air (Prevention and Control of Pollution) Act. c) Water (Prevention and control of Pollution) Act d) Wildlife Protection Act, Forest Conservation Act	09	30

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4	<b>Human Population</b> a) Population growth, variation among nations. b) Population explosion – Family Welfare Programme. Impact of Climate change on Environment and human health.	06	20
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**Course outcome:**

- CO-1: To acquire information regarding different types of pollution, its effect and control mechanism.  
 CO-2: To learn about sustainability, water conservation methods and environmental changes like climate change, global warming, acid rain, etc.  
 CO-3: To learn to implement the various protection laws and would also contribute in developing new preventive measures for the environment.  
 CO-4: To learn about human population and its control measures.

**Reference Books:**

Title	Authors	Publisher
The Biodiversity of India,	Bharucha Erach,	Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India
Environmental Biology,	Agarwal, K.C.	Nidi Publ. Ltd. Bikaner.
Fundamentals of Ecology.	Odum, E.P.	W.B. Saunders Co. USA, 574p

**Chemistry Reference/textbooks Book:**

Title	Author/s	Publication
Molecular biology of cells	David Baltimore, Harvey Lodish	S. Chand Publishing
A textbook of Organic Chemistry	Arun Bahl and B S Bahl	S. Chand
March's Advanced Organic Chemistry Reactions, Mechanisms and structure	Michael Smith and Jerry March	Wiley Publications
Essentials of Physical Chemistry	A. Bahl, B. S. Bahl and G. D. Tuli	S. Chand Publishing
Atkins' Physical Chemistry 10 <sup>th</sup> Edition	Peter Atkins and Julio de Paula	Oxford University Press

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**Course Name:** Chemistry II

**Course Code:** SSES1050

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To study comprehensively about Alkane, Alkene, Alkyne, fundamental reaction mechanisms, about chemical Kinetics, and Thermodynamics

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Hydrocarbons</b> Definitions (Bond distances, Bond angles, Torsion angle, Isomers) (i) Alkanes: Nomenclature, sources, methods of formation, Physical properties and chemical reactions. (iii) Alkenes: Nomenclature, method of preparation, Physical properties, Reactions of alkenes (iv) Dienes: nomenclature, classification of dienes methods of formation of Butadiene chemical reactions 1,2 and 1,4 additions. (v) Alkynes: nomenclature methods of formation, chemical reactions, electrophilic and nucleophilic addition reactions of acetylene.	8	27
2	<b>Fundamentals of reaction mechanism</b> Introduction, Homolytic fission, Heterolytic fission, Classification of reactions, Inductive effect, Electromeric effect, Resonance and mesomeric effect, Hyperconjugation and their applications, Effect of hybridization, Dipole moment, types of arrow, Electrophiles and Nucleophiles, Dipole moment, types of arrow, Electrophiles and Nucleophiles, Leaving groups, Basic idea about Carbocations, Carbanions, Free radicals and Carbenes and their stability, Types of addition reaction, Types of substitution reaction, Types of elimination reaction, mechanism of nucleophilic substitution reaction, mechanism of elimination reaction, steric hindrance, Hydride and alkyl shift, aldol condensation, Beckmann rearrangement.	8	26



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Section-II			
3	<b>Chemical Kinetics</b> Introduction, reaction rate, units of rate, rate laws, order of a reaction, molecularity of a reaction, Molecularity of a complex reaction, Differences between order and molecularity, Pseudo order reactions, zero order reaction, Derivation rate constant equation for zero order reaction, First order reaction, Derivation rate constant equation for first order reaction, Units of rate constant, Half -life of a reaction, Calculation of half-life of a first order reaction	8	27
4	<b>Thermodynamics</b> Introduction, scope and limitation of thermodynamics, System, boundary, surroundings, homogeneous and heterogeneous systems, Types of thermodynamic systems, Intensive and extensive properties, state of system, Equilibrium and non- equilibrium states, Process, Types of processes: Isobaric, Isochoric, Isothermal, adiabatic, reversible and irreversible process, Heat and work, pressure-volume work, Internal energy, Sign conversations and units, First law of thermodynamics, enthalpy of system, Relation between $\Delta H$ and $\Delta E$ , Heat capacity, Specific and molar heat capacities, Concept of entropy, Entropy and its unit	6	20

**Course outcome:**

**CO-1:** To learn about the synthesis and chemical properties of hydrocarbons

**CO-2:** To learn the basics of reaction mechanisms such as electrophile, nucleophile, resonance, Inductive effects, etc.

**CO-3:** To acquire knowledge about the rate of reaction, units of rate, rate laws, order of a reaction, molecularity of a simple and complex reactions

**CO-4:** To obtain knowledge about the relation between enthalpy, types of thermodynamics, etc.

**Reference Books:**

Title	Authors	Publisher
Molecular biology of cells	David Baltimore, Harvey Lodish	S. Chand Publishing
A textbook of Organic Chemistry	ArunBahl and B S Bahl	S. Chand
March's Advanced Organic Chemistry Reactions, Mechanisms and structure	Michael Smith and Jerry March	Wiley Publications
Essentials of Physical Chemistry	A. Bahl, B. S. Bahl and G. D. Tuli	S. Chand Publishing
Atkins' Physical Chemistry 10 <sup>th</sup> Edition	Peter Atkins and Julio de Paula	Oxford University Press

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**Course Name:** Environment & Chemistry Practical II

**Course Code:** SSES1060

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To learn documentation related to the local area, polluted sites, about environment life and basic ecosystem, and determine different properties of solids & liquids, spectrophotometer, and application of chemical kinetics.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Field work: Visit to a local area to document environmental assets i.e. river/forest/grassland/hill/mountain	5
2.	Visit to a local polluted site-Urban/Rural/Industrial/Agricultural	5
3.	Study of common plants, insects, birds.	5
4	Study of simple ecosystems-pond, river, hill slopes, etc.	5
5	Estimation of Dissolved Oxygen in Water sample	10
Chemistry Practical's		
1	To determine the viscosity of a given solvents	6
2	Identify and determine melting point, boiling point, and solubility of various Organic compounds.	6
3	Determination of concentration of unknown solution spectrophotometrically	12
4	To study the monomolecular reaction in the hydrolysis of methyl acetate in 0.5 N HCl at different initial concentrations.	6

**Course outcome:**

**CO-1:** To acquire fundamental knowledge about documentation of local environmental assets

**CO-2:** To have basic understanding to identify some basic plants, insects, etc. and explain their ecosystem

**CO-3:** To acquire knowledge about determination of melting point, boiling point, viscosity, solubility, etc. of solvents

**CO-4:** To learn use of a spectrophotometer and determination of chemical kinetics, rate of reaction and equilibrium constant

**Reference Books:**

Title	Authors	Publisher
The Biodiversity of India,	BharuchaErach,	Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013,India
Environmental Biology,	Agarwal, K.C.	Nidi Publ. Ltd. Bikaner.
Fundamentals of Ecology.	Odum, E.P.	W.B. Saunders Co. USA,574p
March's Advanced Organic Chemistry Reactions, Mechanisms and structure	Michael Smith and Jerry March	Wiley Publications
Essentials of Physical Chemistry	A. Bahl, B. S. Bahl and G. D. Tuli	S. Chand Publishing

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Atkins' Physical Chemistry 10 <sup>th</sup> Edition	Peter Atkins and Julio de Paula	Oxford University Press
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 Syllabus, Teaching and Examination Scheme

**Course Name:** Linguistic Proficiency (A1 Elementary)

**Course Code:** CFLS1010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To use basic grammatical structures in short conversations and discussions, and begin to self-edit their oral and written portion.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Grammar &amp; Vocabulary</b> <b>Grammar</b> <ul style="list-style-type: none"> <li>• Present tense (Simple, Continue, Perfect)</li> <li>• Past tenses (Simple, to be)</li> <li>• Future (Simple)</li> <li>• Modals (Can, could, may, might, must, should, would)</li> <li>• -ing and the infinitive (Verbs + to + infinitive and verbs + -ing)</li> <li>• Identification of parts of speech</li> <li>• there and it</li> <li>• Questions and word Order</li> </ul> <b>Vocabulary</b> <ul style="list-style-type: none"> <li>• Numbers (cardinal/ordinal) and money • Countries, nationalities and languages • Times • Days, dates, months, years and seasons • Shops and places • Interests, sports and activities • Jobs • Rooms and furniture • Colours • Size and weight • Body parts and appearance • Food, meals, cooking • Weather • Transport • Health • Feelings and emotions • Street directions • Clothes (any 4 of these)</li> </ul>	06	20
2	<b>Listening</b> <ul style="list-style-type: none"> <li>• Listening to my last holiday</li> <li>• Listening to my family,</li> <li>• Listening to my flat,</li> <li>• Listening to daily routine</li> <li>• Listening to shopping habits</li> </ul>	06	20
3	<b>Speaking</b> <ul style="list-style-type: none"> <li>• <b>Giving and taking</b> introductions, personal information and family, getting to know each other, greetings, asking for directions and giving directions</li> <li>• Raising or asking and answering simple questions</li> </ul>	06	20

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4	<b>Reading</b> <ul style="list-style-type: none"><li>• <b>Reading of the content of the simpler texts</b> like labels, posters, catalogs, ads, menus, schedules, and guess the unknown words on a contextual basis.</li><li>• <b>Reading of information around us</b> such as announcements, simple advertising, places and activities, job vacancies, etc.</li></ul>	06	20
5	<b>Writing</b> <ul style="list-style-type: none"><li>• Write about themselves</li><li>• Form basic sentences</li><li>• Write about hobbies</li><li>• Writing short personal letters</li></ul>	06	20

**Learning outcomes:**

At the end of the teaching, the students will be able to:

- understands familiar words and phrases that are directly related to everyday communication situations (family, shopping, home, work), when people speak slowly and clearly
- understands short, simple texts and personal messages, can find information from simple daily texts (labels, posters, directories, ads, job offers, menus, schedules)
- can ask questions about others and answer questions on themselves, can communicate in a simple language, if a partner helps her/him, can describe her/his family and other people, living conditions, education and work in a very simple way
- can write a very simple personal message or sentences

**Assessment methods. Assessment criteria:**

- **Listening** – understands the simplest questions and the core of the information hears when the conversation partner speaks slowly and clearly and is ready to repeat.
  - **Reading** – understands the content of the simpler texts (labels, posters, catalogs, ads, menus, job offers, schedules), guesses the unknown words on a contextual basis.
  - **Speaking** – can answer questions about her/himself, speaks about her/himself, family, place of residence food using simple sentences.
  - **Writing** – can write a short message or sentence
  - **Grammar and Vocabulary** – can identify tenses and parts of speech
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**Course Name:** Linguistic Proficiency (A2)

**Course Code:** CFLS1010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To help learners to

- Communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar topics and activities.
- Handle very short social exchanges.
- Read and understand the main ideas of simple texts.
- Structure ideas logically in writing.
- Develop accuracy in the usage of grammar and vocabulary.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Grammar &amp; Vocabulary</b> <b>Grammar</b> <ul style="list-style-type: none"> <li>• Asking Questions—Question forms</li> <li>• Present simple vs present continuous</li> <li>• Past simple—Form and use</li> <li>• However, although, because, so, and time connectors</li> <li>• Will vs be going to—future</li> <li>• Present perfect or past simple?</li> <li>• Much, many, little, few, some, any—quantifiers</li> <li>• Subject and object pronouns, possessive pronouns and adjectives</li> <li>• Prepositions of movement</li> </ul> <b>Vocabulary</b> Families, Restaurants and leisure venues, Personality, Biographical information, Buildings and monuments, Weather, Clothes and accessories, Large numbers, Hobbies, sports and interests, Education, Life changes and events, Animals, Descriptions of people, health, fitness, and illnesses (any 4 of these)	06	20
2	<b>Listening</b> <ul style="list-style-type: none"> <li>• Listening to factual information,</li> <li>• Listening to the weather forecast,</li> <li>• Listening to the content of guidelines,</li> <li>• Listening to everyday communication situation of the family, shopping, home, work,</li> </ul>	06	20

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	<ul style="list-style-type: none"> <li>Listening to simple pair or group talks</li> </ul>		
3	<b>Speaking</b> <ul style="list-style-type: none"> <li><b>Giving and taking</b> introductions, personal information and family, getting to know each other, simpler personal information, greetings, asking for directions and giving directions, accommodation establishments, booking a room, describing weather, seasons, birds, animals, plants</li> <li><b>Descriptions of Food and drink</b> including Cafes, restaurants, and other catering establishments; booking a table, ordering, etc.</li> </ul>	06	20
4	<b>Reading</b> <ul style="list-style-type: none"> <li><b>Reading of the content of the simpler texts</b> like labels, posters, catalogs, ads, menus, job offers, schedules, and guess the unknown words on a contextual basis.</li> <li><b>Reading of information around us</b> such as announcements, advertising, places and activities, job vacancies, etc.</li> </ul>	06	20
5	<b>Writing</b> <ul style="list-style-type: none"> <li>Description of the day</li> <li>Writing messages &amp; experiences</li> <li>Writing on familiar topics</li> <li>Writing short personal letters</li> </ul>	06	20

**Learning outcomes:**

At the end of the teaching, the students will be able to:

- Understand main points or phrases or ideas on everyday communication situations.
- Understand common, basic or job-related language, events, short simple texts, personal letters and can find information from simple daily texts.
- Can handle everyday typical communication tasks, can take and give introductions, can contribute to the conversation, and can describe themselves, their family, other people, food & drink.
- Can write short messages, notes, & personal letters and can also write on simply about familiar topics.
- Show an adequate degree of grammatical control and do not make major mistakes and show an understanding of sufficient vocabulary to conduct routine, everyday communications involving used to situations and topics.

**Assessment methods. Assessment criteria:**

- Listening** – understands the simplest questions and the core of the information hears when the conversation partner speaks slowly and clearly and is ready to repeat.
- Reading** – understands the content of the simpler texts (labels, posters, catalogs, ads, menus, job offers, schedules), and guesses the unknown words on a contextual basis.
- Speaking** – can answer questions about her/himself, speaks about her/himself, family, place of residence food using simple sentences.
- Writing** – can write a short message.
- Grammar and Vocabulary** – can use basic grammar and understand sufficient vocabulary of everyday communications situations.

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**Course Name:** Linguistic Proficiency (B1)

**Course Code:** CFLS1010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To help learners to

- Demonstrate a greater knowledge of linguistic styles and norms.
- Read and understand the main ideas of a variety of texts.
- Structure ideas logically in writing.
- Write clearly and in detail about a wide range of subjects.
- Develop accuracy in the usage of grammar and vocabulary

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Grammar &amp; Vocabulary</b> <b>Grammar</b> <ul style="list-style-type: none"> <li>• Functional use of parts of speech</li> <li>• Questions—different types</li> <li>• Auxiliary verbs</li> <li>• Comparatives using the...the...</li> <li>• Narrative tenses—all past tenses</li> <li>• Position of adverbs and adverb phrases</li> <li>• Gerund or infinitive—verb patterns</li> </ul> <b>Vocabulary</b> Buildings, Appliances, Clothes, Education, Entertainment, Environment, Food and drink, Nature, Personal Feelings, Technology, Weather, Sport (any 3 of these)	06	20
2	<b>Listening Skills</b> <ul style="list-style-type: none"> <li>• Note Taking &amp; Making</li> <li>• Audio Comprehension</li> <li>• Movie Clips, News, documentaries</li> </ul>	06	20
3	<b>Speaking Skills</b> <ul style="list-style-type: none"> <li>• Speaking in various contexts:</li> <li>• Expressing Result, Talking about People/Place/Thing in Relation to Something, Expressing Manner of an Action, Making Supposition about an Action, Describing the process, Connecting Information, Offering Suggestion/Advice, Expressing Choice and Alternative</li> </ul>	06	20



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	Choice		
4	<b>Reading Skills</b> <ul style="list-style-type: none"><li>• Reading Newspaper, Books</li><li>• Summarizing</li><li>• Paraphrasing</li></ul>	06	20
5	<b>Writing Skills</b> <ul style="list-style-type: none"><li>• Technical Writing: Application, Report Writing, Dialogue Writing, Movie Review, Book Review, Letter Writing</li></ul>	06	20

**Learning outcomes:**

At the end of the teaching, the students will be able to:

- Speak confidently and discuss the familiar topics with native speakers in brief.
- Understand lengthy speech and lectures and follow complex arguments of the familiar topic.
- Understand most TV news, the majority of films and current affairs programs in common accents.
- Read articles and reports about common topics, read literature in English
- Write clearly and in detail about a wide range of subjects as well as essays, reports, and letters

**Assessment methods. Assessment criteria:**

- **Listening** – understands the dialogues, instructions, and narration.
  - **Reading** – understands the content of analytical writing, books, newspaper, and magazines
  - **Speaking** – narrate the event, describe the cause and process, and give a short speech on a familiar topic.
  - **Writing** – can write letters, event reports, narrative writing
  - **Grammar and Vocabulary** – can use grammar and vocabulary in the tasks assigned.
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**Course Name:** Linguistic Proficiency (B2)

**Course Code:** CFLS1010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To help learners to

- Read and understand the main ideas of a variety of texts.
- Structure ideas logically in writing.
- Write clearly and in detail about the given topic.
- Develop accuracy in the usage of grammar and vocabulary.
- Create, organize and defend effective oral presentations.
- Clearly arrange paragraphs with main ideas and topic sentences.
- Logically sequence the ideas.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<p><b>Grammar &amp; Vocabulary</b></p> <p><b>Grammar</b></p> <ul style="list-style-type: none"> <li>• Clauses of contrast, purpose, reason, and result</li> <li>• Reflexive and reciprocal pronouns</li> <li>• 'There and it' – preparatory subjects</li> <li>• Speculation and deduction – modal verbs and expressions</li> <li>• Conditionals</li> <li>• Gerunds and infinitives</li> <li>• Functions</li> </ul> <p><b>Vocabulary</b>                      Travel and Tourism, Health and Medicine, Crime and Law, Education, Personality Adjectives, Collocations and Phrases (any 3 of these)</p>	06	20
2	<p><b>Listening Skills</b></p> <ul style="list-style-type: none"> <li>• Understanding the difference between Hearing and Listening and Critical Listening.</li> <li>• Understanding the various texts in the context of the tone and emotion they portray.</li> <li>• Exploring domain-general audio clips and deriving an understanding of the embedded message.</li> <li>• Developing the ability to understand the context of a given</li> </ul>	06	20

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	situation in a conversation/audio clip.		
3	<b>Speaking Skills</b> <ul style="list-style-type: none"> <li>• Exploration of various forms of speech like extempore, elocution, short speech, etc.</li> <li>• Conversational Role Plays and Skits.</li> <li>• Elocution to express one's opinion on various subjects given by the Teacher.</li> <li>• Collaborative discussion to generate different opinions and responses.</li> <li>• Sustaining an interaction; exchanging ideas, expressing and justifying opinions, agreeing and/or disagreeing, suggesting, speculating, evaluating, reaching a decision through negotiation, etc.</li> </ul>	06	20
4	<b>Reading Skills</b> <ul style="list-style-type: none"> <li>• Introduction to Reading Vs Critical Reading.</li> <li>• Reading and discussion of Short Prose with different writing styles.</li> <li>• Understanding vivid descriptions of texts</li> <li>• Description of genres and writing styles that showcase the varying tones and features.</li> <li>• Develop an understanding to read between the lines.</li> </ul>	06	20
5	<b>Writing Skills</b> <ul style="list-style-type: none"> <li>• Summarizing vs. Paraphrasing</li> <li>• Understanding the various texts in the context of the tone and emotion they portray.</li> <li>• Understanding the various forms of written documentation like reports and summary.</li> <li>• Writing activities that assist students in expressing their emotions and feelings.</li> <li>• Writing tasks to generate contrasting ideas, letters for suggestions, letters for the recommendation, essays.</li> </ul>	06	20

**Learning outcomes:**

At the end of the teaching, the students will be able to:

- use writing and reading for inquiry, learning, thinking, and communicating.
- develop knowledge and understanding of Grammar.
- develop abilities to make use of the grammar in own writing and speaking English.
- enhance competencies in writing essays and gist of the passage in own words/ language.
- develop an understanding of specific information, text organization features, tone, and text structure.
- develop an ability to write regular/common/casual text types such as an article, an essay, a letter, an email, a report, a review, or a short story, with a focus on advising, apologizing, comparing, describing, explaining, expressing opinions, recommending, suggesting.
- demonstrate an understanding of attitude, detail, function, genre, gist, main idea, opinion, place, purpose, situation, specific information, relationship, topic, agreement, etc.

**Assessment methods. Assessment criteria:**

- **Listening** – Analyzing audio clips to understand the crux of the clip, A series of short unrelated extracts

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from monologues or exchanges between interacting speakers. The learners are expected to decode the information given like Details, specific information, stated opinion, etc.

- **Reading** – Comprehension Passage Test to help the students establish structure coherence of the given prose/passage, Evaluation of various reading strategies like Skimming and Scanning, Cloze Test, Understanding the structure of different write-ups to visualize descriptions, Critically analyze and draw reports, Matching the mismatched sentence order from the provided text, A text or several short texts preceded by 15 multiple-matching questions, Developing a short story based on a similar genre taught on one's own self.
- **Speaking** – Individual speaking assignments to develop general interactional and social language, Ability to organize a larger unit of conversation; comparing, describing, expressing opinions, Group Discussions on issues of importance, A two-way conversation between the students. The students are given spoken instructions with written and visual stimuli, which are used in a decision-making task, Expressing and justifying opinions, agreeing and/or disagreeing, Setting up interviews like mock testing system.
- **Writing** – Developing existing written texts into alternative texts via paraphrasing, Developing summaries of provided extracts, Essay and Article Writing based on the assigned genre, Exploring understanding of various genres of writing, Writing for specific occasions and events, Developing a vocabulary for writing different genres, Visualizing and then writing about certain incidents, memories, trips, visits, etc., Expressing emotions in various contexts and situations, Writing for special occasions and circumstances.

**Sem-3**

**PPSU**

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 Syllabus, Teaching and Examination Scheme

**Course Name:** Genetics I

**Course Code:** SSBT2010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To make understand about the principle of inheritance, concept of linkage, crossing over, genetic mapping, and chromosomal mutation as well as to solve genetical problems by using Mendelian genetics.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Science of Genetics:</b> Overview of modern history of Genetics; General classification of Genetics (Classical, Molecular & Evolutionary), Mendelian Genetics	09	25
2	<b>Concept of allele and chromosomal inheritance:</b> Alleles, types of alleles, Dominant allele, recessive allele, incomplete dominance, Co dominance, Multiple alleles, lethal alleles with example. Sutton and Boveri Theory, Genetic linkage and its types, crossing over and gene mapping	09	25
Section-II			
3	<b>Chromosomal Mutation: change in structure:</b> Structural changes- deletion, duplication, inversion, translocation, variation in chromosome morphology	06	20
4	<b>Chromosomal Mutation: change in number:</b> Euploidy: monoploidy; polyploidy-autoploidy, allopolyploidy; aneuploidy: monosomy, nullisomy, trisomy, doubletrisomy, Tetrasomy.	06	20

**Course outcome:**

**CO-1:** To gain knowledge about principles of inheritance at the molecular, cellular and organismal levels

**CO-2:** To understand the concept of alleles and chromosomal basis of inheritance.

**CO-3:** To understand the chromosomal inheritance and also learn how to prepare genetic map

**CO-4:** To understand the molecular basis of mutations, diagnosis and treatment of genetic diseases

**Reference Books:**

Title	Authors	Publisher
Principles of Genetics	Gardner	Wiley; 8 edition
Genetics: Analysis and Principles	Robert Booker	McGraw-Hill Publishing
Theory and Problems of Genetics	Stansfield	McGraw-Hill Professional Publication

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Genetics: A conceptual Approach	Pierce	W. H. Freeman; 6 edition
Life science: fundamentals and practice part I & part II	USH &Minar	3 <sup>rd</sup> edition, pathfinder academy

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**Course Name:** Genetics II

**Course Code:** SSBT2030

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To acquire comprehensive knowledge on structure of nucleic acid, gene, genetic material and understand the genome organization of prokaryotic as well as eukaryotic cell.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Nucleic acid as genetic material</b> Characteristics of Genetic material, Protein & nucleic acid as Hereditary material, Experimental evidences: Griffith Experiment, Avery experiment, Hershey experiment, Stanley Experiment	9	30
2	<b>Nucleic acid Structure</b> ➤ DNA structure ➤ DNA topology ➤ RNA structure	6	20
Section-II			
3	<b>Gene concept</b> ➤ Prokaryotic genome: Chromosomal and plasmid ➤ Eukaryotic genome: Chromosomal and organelle (Mitochondrial DNA and Chloroplast DNA) ➤ Fine structure of the Gene: Cistron, muton and recon	9	30
4	<b>Bacterial Genetics</b> ➤ Transformation ➤ Transduction-Generalized and specialized: ➤ Conjugation: F factor mediated, Hfr and Sexduction.	6	20

**Course outcome:**

**CO-1:** To know about characteristics of nucleic acids and the early experimental approaches for establishing nucleic acid as hereditary material

**CO-2:** To understand structural features of nucleic acid

**CO-3:** To gain knowledge about gene structure and characteristic features of prokaryotic and eukaryotic genome

**CO-4:** To understand Bacterial Genetics



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**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Principles of Genetics	Gardner	Wiley; 8 edition
Genetics: Analysis and Principles	Robert Booker	McGraw-Hill Professional Publishing
Theory and Problems of Genetics	Stansfield	McGraw-Hill Professional Publication
Genetics: A conceptual Approach	Pierce	W. H. Freeman; 6 edition
Life science: fundamentals and practice part I & part II	USH & Minar	3 <sup>rd</sup> edition, pathfinder academy

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**Course Name:** Genetics Practical

**Course Code:** SSBT2050

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To practically learn about the staining of chromosomes, phases of mitosis, and how mutation arise This course is designed to practically learn about the staining of chromosomes, phases of mitosis, how mutation arise and to solve genetical problems by Mendelian genetics.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Monohybrid and dihybrid cross	10
2.	Karyotyping with the help of photographs	10
3.	Study of Barr Body	10
4.	Meiosis and mitosis stages from onion root tips	10
5.	Isolation of pigment mutant	10
6.	UV survival of <i>E. coli</i>	10

**Course outcome:**

**CO-1:** To get basic knowledge of genetics and inheritance of characters from one generation to next

**CO-2:** To stain barr body, and isolate the pigment mutant by employing different staining and isolation methods

**CO-3:** To see stages of cell division in onion root tip cells

**CO-4:** To perform mutagenesis experiment in *E. coli* study the effects of UV radiation on *E. coli* cultures

**Reference Books:**

Title	Authors	Publisher
Principles of Genetics	Gardner	Wiley; 8 edition
Genetics: Analysis and Principles	Robert Booker	McGraw-Hill Professional Publishing
Theory and Problems of Genetics	Stansfield	McGraw-Hill Professional Publication
Genetics: A conceptual Approach	Pierce	W. H. Freeman; 6 edition
Life science: fundamentals and practice part I & part II	USH &Minar	3 <sup>rd</sup> edition, pathfinder academy

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**Course Name:** Immunology I

**Course Code:** SSBT2070

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will learn about basic things related to our immune system and about the significance of antibiotics

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Overview of Immune System</b> <ul style="list-style-type: none"> <li>➤ Historical perspective of Immunology</li> </ul> Early theories of Immunology. <ul style="list-style-type: none"> <li>➤ Types of immunity- Innate, Adaptive (cell mediated and humoral)</li> </ul>	6	20
2	<b>Innate Immunity</b> <ul style="list-style-type: none"> <li>➤ Physical barrier</li> <li>➤ Chemical barrier</li> <li>➤ Biological barrier</li> </ul> <b>Adaptive immunity</b> <ul style="list-style-type: none"> <li>➤ B-lymphocytes</li> <li>➤ T-lymphocytes</li> <li>➤ Antigen presenting cell</li> </ul>	09	30
Section-II			
3	<b>Antigens</b> Characteristics of antigen, types of antigens, Immunogenicity Versus Antigenicity, Factors that Influence Immunogenicity, Epitopes, Haptens and the Study of Antigenicity, Pattern-Recognition Receptors	06	20
4	<b>Antibodies</b> Immunoglobulins - Structure and Functions, classes and function. Monoclonal antibodies, Hybridoma technology	09	30

**Course outcome:**

**CO-1:** To understand the cells of the immune system, history and early theories of immunity

**CO-2:** To learn about the barriers of the body defense mechanism and major types of cells involved in defense

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responses

**CO-3:** To study the characteristics, structure and functions of the antigens and the determining sites

**CO-4:** To acquire knowledge about the antibodies, their structure and functions

**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Immunology	Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J.	W H Freeman & Co; 7th edition
Roitt's Essential Immunology	Delves, P. J., Martin, S. J., Burton, D. R., Roitt, I.M. (2006).	XI Edition. Roitt's, Blackwell Publishing

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**Course Name:** Immunology II

**Course Code:** SSBT2090

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will learn about basic things related to our immune system  
 Understand the significance of vaccines and Auto-Immune Diseases

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Cells and Organs of The Immune system</b> <ul style="list-style-type: none"> <li>➤ Hematopoiesis and role of hematopoietic factors, Cells of the immune system.</li> <li>➤ Organs of the Immune system: Primary and Secondary lymphoid organs, Lymphatic system.</li> <li>➤ Systemic Function of the Immune system Lymphoid Cells and Organs—Evolutionary Comparisons</li> </ul>	6	20
2	<b>Antigen-Antibody Interactions: Principles and Applications</b> <ul style="list-style-type: none"> <li>➤ Antigen-antibody affinity and avidity</li> <li>➤ Cross reactivity</li> <li>➤ Precipitation reaction</li> <li>➤ Agglutination</li> </ul>	9	30
Section-II			
3	<b>Vaccines &amp; Vaccination</b> <ul style="list-style-type: none"> <li>➤ Adjuvants,</li> <li>➤ Types of vaccines</li> <li>➤ Principles of vaccination</li> <li>➤ Passive and Active immunization</li> <li>➤ Immunization programs and role ofWHO</li> </ul>	9	30
4	<b>Auto-Immune Diseases</b> Immune Dysfunction and Its Consequences, Autoimmunity & auto-immune diseases, factors contributing development of auto-immune diseases, mechanism of development, breakdown of self-tolerance,	6	20

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	rejection of transplants, molecular mimicry, diagnosis & treatment of auto-immune diseases, immunodeficiency, AIDS, hypersensitivity reactions, types and examples		
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**Course outcome:**

**CO-1:** To learn basics of immune system, its importance aspects of its functioning

**CO-2:** To acquire the knowledge of hematopoietic stem cell lineage, primary and secondary lymphoid organs of Immune system.

**CO-3:** To learn about the immune response against antigens, generation of antibodies

**CO-4:** To learn about the Auto-Immune diseases, its consequences, diagnosis and treatment

**Reference Books:**

Title	Authors	Publisher
Immunology	Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J.	W H Freeman & Co; 7th edition
Roitt's Essential Immunology	Delves, P. J., Martin, S. J., Burton, D. R., Roitt, I.M. (2006).	XI Edition. Roitt's, Blackwell Publishing

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**Course Name:** Immunology Practical

**Course Code:** SSBT2110

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to help students to develop skills and practice the application of antigen antibody reaction to detect the various diseases.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Antigen-Antibody reactions – Agglutination (Blood grouping testing).	10
2.	Single diffusion in two dimension (Mancini Assay)	10
3.	ELISA Method	10
4.	Syphilis slide agglutination test	10
5.	Widal test	10
6.	Total count of blood cells	10

**Course outcome:**

**CO-1:** To learn about the Antigen-Antibody reactions

**CO-2:** To acquire knowledge about various immunological techniques

**CO-3:** To perform various clinical immunological tests

**CO-4:** To learn the techniques for handling and testing the blood samples

**Reference Books:**

Title	Authors	Publisher
Immunology	Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J.	W H Freeman & Co; 7th edition
Roitt's Essential Immunology	Delves, P. J., Martin, S. J., Burton, D. R., Roitt, I.M. (2006).	XI Edition. Roitt's, Blackwell Publishing

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**Course Name:** Biochemistry and Metabolism I

**Course Code:** SSBT2130

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to enable students to gain knowledge about structure, properties and functions of basic biological macromolecules

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Carbohydrates</b> <ul style="list-style-type: none"> <li>➤ Introduction, classification and biological significance</li> <li>➤ Monosaccharides (Epimers &amp; cyclic form) and disaccharides in details with suitable example</li> <li>➤ Glycosidic linkage</li> <li>➤ Polysaccharides (homo and hetero-polysaccharides) with suitable examples</li> <li>➤ Reducing and Non reducing sugar</li> </ul>	6	20
2	<b>Lipids</b> <ul style="list-style-type: none"> <li>➤ Introduction, structure of lipids (fatty acids &amp; alcohol)</li> <li>➤ Classification of fatty acids (saturated, unsaturated, hydroxy, cyclic, essential and non-essential)</li> <li>➤ Classification of lipid</li> <li>➤ Simple lipids-Fats, Oil, Waxes</li> <li>➤ Compound lipids- phospholipids, glycolipids</li> <li>➤ Derived lipids-steroids, terpenes, carotenoids</li> <li>➤ Biological importance of lipids</li> </ul>	9	30
Section-II			
3	<b>Proteins</b> <ul style="list-style-type: none"> <li>➤ Introduction and classification of amino acids, Essential and non-essential amino acids</li> <li>➤ Proteins: classification, Structure, properties and importance</li> </ul>	9	30
4	<b>Nucleic Acids</b> <ul style="list-style-type: none"> <li>➤ Nucleosides, nucleotides, Polynucleotide, Forces stabilizing nucleic acid structure.</li> </ul>	6	20



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	<ul style="list-style-type: none"> <li>➤ Structure of DNA: Watson and Crick model</li> <li>➤ Different forms of DNA duplex</li> <li>➤ Structure and types of RNA</li> </ul>		
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**Course outcome:**

**CO-1:** To acquire knowledge about biological macromolecules

**CO-2:** To acquire knowledge about the structure and chemical characteristics of macromolecules

**CO-3:** To acquire knowledge about basic properties of carbohydrates, proteins, amino acids and Nucleic acids

**CO-4:** To acquire knowledge about functions of different biological macromolecules

**Reference Books:**

Title	Authors	Publisher
Principles of Biochemistry	Lehninger	5 <sup>th</sup> Edition(2008)David Nelson & Michael Cox, W.H. Freeman and company, NY.
Biochemistry	Powar CB and Chatwal GR (2002).	Himalaya Publishing house, India.
Biochemical Methods	S. Sadashivam, A. Manickam (1995)	NewAgeInternational Publishers, India
AnIntroduction toPractical Biochemistry.	David Plummer	3 <sup>rd</sup> Edition,(2001),Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India

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**Course Name:** Biodiversity and Conservation

**Course Code:** SSBT2190

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To acquire knowledge about the importance and monitoring of level of biodiversity as well as the concept of biodiversity conservation and its importance to maintain ecological balance.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>DEFINING BIODIVERSITY:</b> Components of Biodiversity. Biodiversity crisis and biodiversity loss. Importance of biodiversity in daily life. Biodiversity and climate change.	6	20
2	<b>TYPES OF ECOSYSTEMS:</b> India as mega biodiversity Nation. Hot spots and biodiversity in India. Biodiversity and Ecosystem functioning. Plant and Animal systematic. Species concept in biodiversity studies	9	30
Section-II			
3	<b>MODERN TOOLS IN THE STUDY OF BIODIVERSITY:</b> Endemism, endemic plants and animals; Assessment of mapping of biodiversity; GIS/Remote sensing; Biotechnology and Conservation, IUCN; Germplasm banks, National Parks, Botanical Gardens; Wildlife Sanctuaries, Bioresources	9	30
4	<b>CROP DIVERSITY:</b> Wild relatives of cultivated plant; Domesticated diversity; Spice diversity; Forest diversity and wildlife.	6	20

**Course outcome:**

**CO-1:** To acquire knowledge about biodiversity and its threats

**CO-2:** To solve issues related to wildlife conservation and management.

**CO-3:** To understand the influence of the environment on plant growth and crop yields

**CO-4:** To recognize the factors need to find sustainable approaches for food and fiber crops production

**Reference Books:**

Title	Authors	Publisher
Terrestrial Ecosystems	Aber, J.D. and Melillo J.M	W.B. Saunders 2; 1991
Diversity and Evolution of land plants 1992	Ingrowille, M	Chapman and Hall, 1992

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Environmental Risk and Hazards.	Cutter, S.L.	Prentice-Hall of Pvt.Ltd.,New 1999
Health and Environmental Risk Analysis Fundamentals with applications.	Joseph, F. L. and Louver, B.D.	PrenticeHall,Jersey, 1997
RiskAssessment in Environmental Management	Kofi, A.D.	John Wiley andSingapore, 1998.
RiskAssessment and Management Handbook.	Kolluru R., Bartell S.,Pitblado R. and Stricoff, S.	McGraw Hill Inc., NewYork, 1996

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**Course Name:** Biochemistry and Biodiversity Practical

**Course Code:** SSBT2250

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To acquire basic knowledge and understanding the concept and importance of biodiversity as well as gain practical knowledge to analyses the oxygen demand in biological samples like BOD, COD.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Sugar estimation by Cole's methods	5
2.	Estimation of amino acids by ninhydrin reagent	5
3.	Acid values of fats and oil by KOH titration	5
4.	Estimation of starch and cholesterol	5
5.	Estimation of protein by Lowry method.	5
6	Identification of biomolecules	5
Sr. No	Name of Practical	Hours
1	To study the biodiversity in forest/pond/river/dessert ecosystem	5
2.	Study of a few endangered species of amphibians, reptiles, birds and mammals of India	5
3.	Report on visit to National Park/Wildlife sanctuary/Botanical garden.	5
4.	To determine the amount of dissolved oxygen in given water sample.	5
5	To determine the BOD value	5
6	To determine the COD value	5

**Course outcome:**

**CO-1:** To acquire knowledge of biodiversity in different ecosystem (forest, pond river, desert)

**CO-2:** To acquire knowledge of endangered species of amphibians, reptiles, birds and mammals of India

**CO-3:** To learn BOD estimation from water sample

**CO-4:** To learn COD estimation from water sample

**Reference Books:**

Title	Authors	Publisher
Biochemical Methods	S. Sadashivam, A. Manickam (1995)	NewAgeInternational Publishers, India
An Introduction to Practical Biochemistry	David Plummer	3 <sup>rd</sup> Edition,(2001), Tata McGraw Hill Edu. Pvt. Ltd. New Delhi, India

**P P Savani University**  
**School of Sciences**  
 Syllabus, Teaching and Examination Scheme

**Course Name:** Creativity, Problem Solving & Innovation

**Course Code:** SEPD4010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
3	0	0	3	100	00	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To develop knowledge to enhance their creativity and improve the way of thinking to deal with various problems.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Introduction to Creativity, Problem Solving and Innovation</b> <ul style="list-style-type: none"> <li>• Definitions of problem solving, Creativity and Innovation</li> <li>• Need for Problem Solving and Innovation &amp; Scope of creativity</li> <li>• Types and Styles of Thinking</li> <li>• Strategies to develop Creativity, Problem Solving and Innovation skills</li> </ul>	8	17
2	<b>Questioning and Learning</b> <ul style="list-style-type: none"> <li>• Introduction to questioning, learning and visualization and its strategies</li> <li>• Sources and methods of questioning and learning</li> <li>• Finding perspective, Visualizing thinking</li> <li>• Mind Mapping</li> </ul>	7	16
3	<b>Creative Thinking and Problem Solving</b> <ul style="list-style-type: none"> <li>• Need of creative thinking</li> <li>• Cracking Creativity - Reversals, Reversing Perspective, seeing all sides, Looking in other world</li> <li>• Finding what you are not looking for and following up</li> <li>• Fishbone diagram</li> <li>• SCAMPER Technique</li> </ul>	8	17
Section-II			
4	<b>Logic and Reasoning</b> <ul style="list-style-type: none"> <li>• Basic concept of Logic</li> <li>• Divergent Vs Convergent Thinking, Inductive Vs Deductive thinking</li> <li>• Fusion of ideas for problem solving</li> <li>• Moral Reasoning</li> <li>• Improvisation</li> </ul>	8	17
5	<b>Practices of Playing</b> <ul style="list-style-type: none"> <li>• Collaboration and Brainstorming</li> <li>• The Spirit of Koinonia</li> </ul>	7	16

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	<ul style="list-style-type: none"> <li>• QFT Model</li> <li>• Connecting the unconnected</li> <li>• Making novel combinations</li> </ul>		
6	<b>Review Strategies for Creative problem-solving methods</b> <ul style="list-style-type: none"> <li>• A Heuristic technique</li> <li>• Problem-Solving Strategies: Why Bother?</li> <li>• Five building blocks as per Fogler &amp; LeBlanc.</li> <li>• Strategy for critical thinking for Choosing</li> <li>• Lateral Thinking</li> <li>• Six thinking hats by Edward de Bono</li> <li>• Design Thinking</li> </ul>	7	17

**Course outcome:**

**CO-1:** To establish creativity in their day-to-day actions and educational output

**CO-2:** To solve all types of problems with an optimistic and an impartial attitude

**CO-3:** To reflect innovatively and work towards problem solving in a tactical way

**CO-4:** To initiate different and advanced practices in their selected field of profession

**Text Book(s):**

Title	Authors	Publisher
Thinker Toys	Michael Michalko	Random House Publication 2006
Crackling Creativity, The Secrets of Creative Genus	Michael Michalko	Ten Speed Press 2001

**Reference Book(s):**

Title	Author/s	Publication
Zig Zag, The Surprising Path to Greater Creativity	R Keith Sawyer	Jossy-Bass Publication 2013
De Bono's Thinking Course	Edward De Bono	Penguin Publication 1994
Six Thinking Hats	Edward De Bono	Penguin Publication 1999
How to Mind Map	Tony Buzan	Thorsons Publication 2002
The Myths of Innovation	Scott Berkum	Berkun Publication 2010
Creative confidence: Unleashing the creative Potential within Us all	Tom Kelly and David Kelly	William Collins Publication 2013
The all Laughed	Ira Flatow	Harper Publication 1992
The Ultimate Lateral & Critical Thinking Puzzle book	Paul Sloane, Des MacHale & M.A. DiSpezio	Sterling Publication 2002

**Course Evaluation:**

Section	Module No.	Evaluation Criteria	Marks
1	1	Group Activity on Brainstorming	15
	2	Mind Mapping Activity	10
	3	Chart Preparation on 'Practicality of Fishbone Diagram'	15
		Group presentation on 'SCAMPER Technique & its applications'	10
2	1	Group Presentation on Critical Analysis of a Govt. scheme/ policy/ budget (merit/ demerit, pros/cons etc)	15
	2	Group Discussion/ Debate/ Elocution	10

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	3	Problem Solving Activity (Individual)	10
		Presentation (Learning Outcomes)	15
<b>Grand Total</b>			<b>100</b>

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**Course Name:** Foreign Language I (German)

**Course Code:** CFLS3010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To help learner to

- Develop and integrate the use of the four language skills i.e. listening, speaking, reading and writing.
- Use the language effectively and appropriately on topics of everyday life situations.
- Develop an interest in the appreciation of German.
- Develop an intercultural awareness.
- Enhance the ability of the candidates to express their ideas and feelings in their own words and for them to understand the use of correct language.
- Appreciate the language as an effective means of communication.
- Understand language when spoken at normal conversational speed in everyday life situations.
- Understand the basic structural patterns of the language, vocabulary and constructions

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Introduction to German</b> <ul style="list-style-type: none"> <li>• Alphabets</li> <li>• German accents</li> <li>• German Numbers</li> <li>• What are the similarities and differences between English and German?</li> <li>• Greetings</li> </ul>	2	15
2	<b>German Time</b> <ul style="list-style-type: none"> <li>• Basic Introduction</li> </ul>	2	15
3	<b>Vocabulary part-1</b> <ul style="list-style-type: none"> <li>• The days of the week</li> <li>• The months of the year</li> <li>• Seasons</li> <li>• Directions &amp; Weather</li> </ul>	2	05
4	<b>Vocabulary part-2</b> <ul style="list-style-type: none"> <li>• Family</li> <li>• Colors and Shapes</li> <li>• Day/time indicators</li> <li>• Body parts</li> <li>• Clothing</li> </ul>	2	07
5	<b>Vocabulary Part-3</b> <ul style="list-style-type: none"> <li>• Food and Meals</li> <li>• Fruits, Vegetables and Meats</li> </ul>	2	05



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	<ul style="list-style-type: none"> <li>Sports and Hobbies</li> </ul>		
6	<ul style="list-style-type: none"> <li>Transportation</li> <li>House and Furniture</li> </ul>	2	05
7	<ul style="list-style-type: none"> <li>School Subject</li> <li>Places</li> <li>Common Expressions</li> </ul>	2	05
<b>Section-II</b>			
1	<b>German grammar</b> <ul style="list-style-type: none"> <li>Verb Sein (to be)</li> <li>Verb Haben (to have)</li> <li>Introduction of Regular verbs and Irregular verb</li> <li>Konjugation of Regular verb</li> <li>First group verbs('EN' group)</li> </ul>	2	10
2	<ul style="list-style-type: none"> <li>Second group verbs('Ten/Den' group)</li> <li>Konjugation of Irregular verbs</li> <li>Third group verbs (Stem change verb)</li> <li>Fourth group verbs (Spell Change Verb)</li> </ul>	2	10
3	<ul style="list-style-type: none"> <li>Nicht trennbare und trennbare Verben</li> <li>Die Modalverben</li> <li>Personalpronomen-Nominativ</li> </ul>	2	10
4	<ul style="list-style-type: none"> <li>W-Frage</li> <li>Ja/Nein-Fragen</li> <li>Nomen und Artikel-Nominativ</li> <li>Die Anrede</li> </ul>	2	10
5	<ul style="list-style-type: none"> <li>Nomen-Genusregeln</li> <li>Adjektiv</li> <li>Nomen und Artikel-Akkusativ</li> <li>Personalpronomen-Akkusativ</li> </ul>	2	10
6	<ul style="list-style-type: none"> <li>Practice of Writing</li> <li>Practice of Speaking</li> </ul>	2	-
7	<ul style="list-style-type: none"> <li>Practice of Listening</li> </ul>	2	-
8	<ul style="list-style-type: none"> <li>Practice of Reading</li> </ul>	2	-

**Course outcome:**

**CO-1:** To demonstrate the level of proficiency necessary to enable them to function in an environment where German is used exclusively

**CO-2:** To demonstrate speaking, listening, reading, and writing in German

**CO-3:** The exam certification will be valid throughout the world

**Text Book(s):**

Title	Authors	Publisher
Namaste German	Yoshita Dalal	Yoshita Dalal

**Reference Book(s):**

Title	Authors	Publisher
Fit In Deutsch	Hueber	Goyal Publication

**Web Material Links:**

- [https://www.youtube.com/watch?v=iGovllrEsF8&list=PLRps6yTcWQbpoqIOcmqMeI1HLnLIRmO\\_t](https://www.youtube.com/watch?v=iGovllrEsF8&list=PLRps6yTcWQbpoqIOcmqMeI1HLnLIRmO_t)
- <https://www.youtube.com/watch?v=GwBfUzPCiaw&list=PL5QyCnFPRx0GxaFjdAVkx7K9TfEkiY4sg>

**P P Savani University**  
**School of Sciences**  
 Syllabus, Teaching and Examination Scheme

**Course Name:** Integrated Personality Development Course (IPDC-I)

**Course Code:** SEPD3040

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	1	100	00	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To help learners to

- provide students with a holistic education – focused on increasing their intelligence quotient, physical quotient, emotional quotient and spiritual quotient
- provide students with hard and soft skills, making them more marketable when entering the workforce
- educate students on their social responsibilities as citizens of India
- provide students with a value-based education which will enable them to be successful in their family, professional, and social relationships.
- teach self-analysis and self-improvement exercises to enhance the potential of the participants.

**Course Contents:**

Section-I			
Lecture No.	Content	Hours	Weightage (%)
1	Remaking Yourself - Restructuring Yourself	2	50
2	Remaking Yourself - Power of Habit	2	
3	Remaking Yourself - Developing Effective Habits	2	
4	Learning from Legends - Tendulkar and Ratan Tata	2	
5	From House To Home - Affectionate Relationship	2	
6	Facing Failures - Failures are not Always Bad	2	50
7	Facing Failures - Insignificance of Failures.	2	
8	Facing Failures - Insignificance of Failures	2	
9	Facing Failures - Failures can be Overcome	2	
10	Learning from Legends - Yogiji Maharaj and Nelson Mandela.	2	

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**Course Evaluation:**

**Theory:**

- Continuous Evaluation consists of 40 marks. There will be a mid-term exam which will assess the current progress of students, it assessed out of 20 marks and will be equivalent to 20 marks of the Continuous Course Evaluation (CCE). There will be a submission consisting 10 marks as per the guidelines of course coordinator and average of the attendance consisting 10 marks (minimum 60 percentage attendance is required).
- End semester exam (ESE) part A 30 marks and part B 30 marks.

**Course Outcome(s):**

After completing the IPDC course (lecture and full participation in activities/challenges), we would like to see PPSU students:

- To have gained a greater sense of social responsibility
- To have gained marketable hard and soft skills that would directly apply to their future careers
- To have gained greater insight and ability to navigate their family, social, and professional relationships along with difficult situations which may arise in their life
- To have a broader sense of self-confidence and a defined identity
- To have greater value for living a moral and ethical life based on principles taught in the course

**P P Savani University**  
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 Syllabus, Teaching and Examination Scheme

**Course Name:** Global Communication Skills

**Course Code:** CFLS1020

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To help learners to

- hone basic communication skills by exposing them to the key communication techniques.
- improvise comprehension and expressional skills which are required for personal, social, academic and professional environment.
- sharpen communication skills with reference to organizational structure.
- show the importance of teamwork and give practice in group communication with reference to group dynamics.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Introduction to Communication Skills</b> <ul style="list-style-type: none"> <li>• Concept and Process of Communication</li> <li>• Types of Communication</li> <li>• Principles of Effective Communication</li> <li>• Barriers to Communication</li> </ul>	10	33
2	<b>Interpersonal Organizational Communication</b> <ul style="list-style-type: none"> <li>• Styles and Flows of Communication</li> <li>• Essentials of Organizational Communication</li> <li>• Kinesics, Proxemics and Chronemics</li> </ul>	03	10
3	<b>Team/ Group Dynamics and Leadership</b> <ul style="list-style-type: none"> <li>• Types of Groups and Essentials of Group Work and Networking</li> <li>• Concept and Types of Leadership</li> <li>• Traits of an Effective Leader</li> </ul>	03	10
4	<b>Presentation Skills</b> <ul style="list-style-type: none"> <li>• Modes, Means and Purposes of Presentation</li> <li>• Audience Analysis and Content Organization</li> <li>• Visual aids and Nuances of Delivery</li> <li>• Non-Verbal Cues for Effective Presentation</li> </ul>	08	27
5	<b>Writing Skills</b> <ul style="list-style-type: none"> <li>• Technical Writing: Application, Report Writing, Dialogue Writing, Movie Review, Book Review, Letter Writing</li> </ul>	06	20

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**Text Book(s):**

Title	Author/s	Publication
Practical Techniques to Develop Communication Skills	ParulPopat& Kaushal Kotadia	PothiPrakashan, 2015

**Reference Book(s):**

Title	Author/s	Publication
Communication Skills	ParulPopat& Kaushal Kotadia	Pearson, 2015
Communication Skills, Second Edition	Sanjay Kumar, PushpLata	Oxford University Press,2015
Communication Skills for Engineers	Sunita Mishra	Pearson, 2011
Effective Interpersonal and Team Communication Skills for Engineers	Clifford Whitcomb, Leslie E. Whitcomb	John Wiley & Sons, 2012

**Web Material Link (s):**

- <http://www.mindtools.com/page8.html>
- [http://techpreparation.com/soft-skills.htm?gclid=CJf34fyQv5wCFdMtpAodjjX\\_tA](http://techpreparation.com/soft-skills.htm?gclid=CJf34fyQv5wCFdMtpAodjjX_tA)
- <http://lorien.ncl.ac.uk/ming/Dept/Tips/present/comms.htm>

**Course Evaluation:**

**Theory:**

- Continuous Evaluation consists of 40 marks. This carries two tests/ presentations/group discussions each of 20 marks.
- End Semester Examination comprising of 60 marks will carry application based and skill testing questions.

**Course Outcome(s):**

Students will be able to

- follow the process of communication and its components in organizational context.
- express themselves and to participate in the classroom discussions and other such academic activities.
- comprehend whatever they receive from Informal Interactions with the family, teachers and friends; and from Formal Communications taking Place in Lectures, Laboratories and the like.
- enhance the teamwork and collaborative attitude.
- communicate effectively using suitable styles and techniques.
- able to participate in the group discussions and other such academic or academic support activities.
- use language effectively with reference to communication in groups and group behavior.

**Sem-4**

PPSU

**P P Savani University**  
**School of Sciences**  
 Syllabus, Teaching and Examination Scheme

**Course Name:** Instrumentation and Techniques

**Course Code:** SSBT2020

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

This course is designed to enable students to acquire basic understanding of the structural and functional analysis of various biomolecules by using various instrumentation techniques like spectroscopy, chromatography.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Planar Chromatography</b> (Principles, Instrumentation and application) Classification of chromatography a) Paper Chromatography(PC) Thin Layer Chromatography(TLC) b) HPTLC	6	20
2	<b>Gas Chromatography</b> Principle of GC, Components of GC, Carrier gas and its selection, System for sample introduction, Column and its specifications, Characteristics and classification of Detectors (FID and TCD), Applications of GC, Limitations of GC.	9	30
Section-II			
3	<b>Liquid Chromatography</b> Limitations of conventional liquid Chromatography, Principle and diagram of instrument, Components of instrument, Column of HPLC, Detectors (UV absorption, RI detector), Applications of HPLC.	9	30
4	<b>Spectroscopy</b> (Principles, Instrumentation and applications) a) Circular Dichroism(CD) b) Fluorescence c) Infrared (IR) d) <sup>1</sup> H NMR (ProtonNMR)	6	20

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**Course outcome:**

**CO-1:** To perform the separation of organic molecules by paper chromatography

**CO-2:** To learn working principle of Gas Chromatography their Characteristics and classification

**CO-3:** To learn about conventional liquid chromatography and HPLC, their principle, working, instrumentation and applications

**CO-4:** To learn about different type of Spectroscopy its principles and applications

**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Principles and Practice of Modern Chromatographic Methods	Robards K., Jackson P. E., Haddad P. A.	Elsevier Academic Press
Fundamentals of Analytical Chemistry	Douglas A. S., Donald M. W., Holler H. J., Crouch H. R.	Brooks Cole; 9 edition
Introduction to Spectroscopy	Donald L. P., Gary M. L., George S. K., James A. V.	Brooks Cole
<b>Title (for second course)</b>	<b>Author/s</b>	<b>Publication</b>
Principles of Gene Manipulation and Genomics	Sandy B. Primrose, Richard Twyman	Blackwell Publisher
Gene Cloning and DNA Analysis: An Introduction	T. A. Brown	Wiley Publisher
Biotechnology	U Satyanarayana	Books and Allied P LTD.



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 Syllabus, Teaching and Examination Scheme

**Course Name:** Bio-analytic Techniques

**Course Code:** SSBT2040

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will acquire the fundamental knowledge about Electrophoresis, PCR techniques and its application in the field of biotechnology

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Electrophoresis</b> Electrophoresis Theory & Principle, Various factors affecting electrophoresis, Horizontal and vertical Electrophoresis. Electrophoresis of DNA and RNA.	6	20
2	<b>Electrophoresis Techniques</b> Native PAGE, Sodium dodecyl sulphate (SDS)- polyacrylamide ➤ gel electrophoresis (PAGE), 2-D Gel Electrophoresis, Capillary Electrophoresis, Application of capillary electrophoresis	9	30
Section-II			
3	<b>Nucleic Acids Hybridization</b> Labeling of Nucleic acids (isotopic and non-isotopic labeling methods), Blotting and types: Southern, Northern and Western	6	20
4	<b>Polymerase Chain Reaction</b> Polymerase Chain Reaction: Principle and Steps, Modification ➤ to PCR Techniques (Types of PCR), Application of PCR in Biological fields	9	30

**Course outcome:**

- CO-1:** The student will have introduction and comparison of various separation techniques  
**CO-2:** The student will study agarose gel electrophoresis, SDS-PAGE, 2-D Gel and capillary electrophoresis.  
**CO-3:** The student will get knowledge of various types labeling techniques and also detection of labeled fragment.  
**CO-4:** The students get acquainted with PCR, optimization of PCR, uses and types of PCR

**Reference Books:**

Title	Authors	Publisher
Principles and Practice of Modern Chromatographic Methods	Robards K., Jackson P. E., Haddad P. A.	Elsevier Academic Press

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Fundamentals of Analytical Chemistry	Douglas A. S., Donald M. W., Holler H. J., Crouch H. R.	Brooks Cole; 9 edition
Introduction to Spectroscopy	Donald L. P., Gary M. L., George S. K., James A. V.	Brooks Cole
Principles of Gene Manipulation and Genomics	Sandy B. Primrose, Richard Twyman	Blackwell Publisher
Gene Cloning and DNA Analysis: An Introduction	T. A. Brown	Wiley Publisher
Biotechnology	U Satyanarayana	Books and Allied P LTD.

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**Course Name:** Bioanalytical Practical

**Course Code:** SSBT2060

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

This course is designed to enable students to acquire practical understanding of various bioanalytical techniques for the qualitative and quantitative analysis of biomolecules.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Identification of Amino Acids in Food by Paper Chromatography.	06
2.	Separation of amino acid mixture by Paper Chromatography.	06
3.	TLC Separation of Drug	06
4.	Agarose gel electrophoresis of genomic DNA	06
5.	SDS PAGE of Protein	12
6.	Southern blotting of DNA	12
7.	DNA amplification by PCR method	12

**Course outcome:**

**CO-1:** To learn about Chromatography and Electrophoresis

**CO-2:** To learn handling and proper storage conditions for macromolecules

**CO-3:** To study Chromatography, its types and Electrophoresis

**CO-4:** To prepare appropriate reagents for the isolation and characterization of the macromolecule

**Reference Books:**

Title	Authors	Publisher
Principles and Practice of Modern Chromatographic Methods	Robards K., Jackson P. E., Haddad P. A.	Elsevier Academic Press
Fundamentals of Analytical Chemistry	Douglas A. S., Donald M. W., Holler H. J., Crouch H. R.	Brooks Cole; 9 edition
Introduction to Spectroscopy	Donald L. P., Gary M. L., George S. K., James A. V.	Brooks Cole
Principles of Gene Manipulation and Genomics	Sandy B. Primrose, Richard Twyman	Blackwell Publisher
Gene Cloning and DNA Analysis: An Introduction	T. A. Brown	Wiley Publisher
Biotechnology	U Satyanarayana	Books and Allied P LTD.

**P P Savani University**  
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 Syllabus, Teaching and Examination Scheme

**Course Name:** Molecular Biology I

**Course Code:** SSBT2080

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will acquire the fundamental knowledge about genome, genome structure and central dogma processes via this course

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>INTRODUCTION</b> Origin of term molecular biology, Development of Molecular Biology, Classical and New Molecular Biology, Experimental Organisms in Molecular Biology	6	20
2	<b>Organization of Genome</b> Definition of a gene and types of genes, Genome, Organization of chromatin: Nucleosome concept and packaging of DNA into higher order structures, Chromosome: structure and types, Lampbrush and polytene chromosomes.	9	30
Section-II			
3	<b>Replication of DNA</b> Structure of DNA, Types/forms of DNA, Semiconservative nature of DNA replication, Origin of replications, Enzymology of DNA replication, Mechanism of replication in prokaryotes and eukaryotes, Proteins associated with DNA replication, Replication Models, Inhibitors of DNA replication.	9	30
4	<b>Mutation and DNA repair</b> Mutation and its types, Necessity of DNA repair, Types of mistakes in DNA, Agents causing damage/mistakes in DNA, Biochemical mechanism of DNA repair	6	20

**Course outcome:**

**CO-1:** To acquire knowledge about molecular biology its advancements and model (experimental) organisms.

**CO-2:** To understand about the genome organization (experimental) of model organisms.

**CO-3:** To acquire knowledge about DNA replication and their associate proteins

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**CO-4:** To obtain knowledge about DNA damages and mutations, and their repair mechanism

**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Fundamentals of Molecular Biology	Veer Bala Rastogi	Anne Book Publisher. 2010
Cell and Molecular Biology: Concepts and Experiments. VI Edition.	Karp, G. (2010).	John Wiley & Sons. Inc.
Molecular Biology of the Gene (VI Edition).	Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008)	Cold Spring Harbour Lab. Press, Pearson Pub.

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 Syllabus, Teaching and Examination Scheme

**Course Name:** Molecular Biology II

**Course Code:** SSBT2100

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to gain knowledge of transcription, post transcriptional modification, translation, post translational modification and regulation of gene expression.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>DNA-dependent synthesis of RNA</b> RNA structure and types, DNA-dependent RNA polymerase, sigma factor, bacterial promoters, The three stages of RNA synthesis, initiation, elongation and termination, rho-dependent and rho-independent termination, Transcription in eukaryotes, inhibitors of transcription.	6	20
2	<b>RNA processing/post transcriptional modification</b> Modification of eukaryotic mRNA at the 5' and the 3' end, splicing introns, differential RNA processing, processing of rRNAs and tRNAs, special function, RNAs, RNA as enzyme.	9	30
Section-II			
3	<b>Genetic code and Translation</b> The genetic code, nature and characteristics of genetic code, cracking the genetic code, degeneracy, wobble hypothesis, Raw materials for protein synthesis, structure of tRNAs, the five stages of protein biosynthesis, aminoacyl-tRNA synthetases, initiation in prokaryotes and in eukaryotes, elongation, termination, Protein folding and processing, inhibitors of protein synthesis.	6	20
4	<b>Regulation of Gene Expression</b> Regulation of gene activity, negative and positive regulation, mechanism of gene regulation at transcriptional level, concept of operons, regulatory proteins, activators, repressors, DNA binding domains. Regulation of gene expression in bacteria, lac operon and trp operon.	9	30

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**Course outcome:**

**CO-1:** to Study the structure and function of RNA polymerase, Initiation, elongation, termination in prokaryotes and eukaryotes

**CO-2:** To know the mechanism involved in Capping, Tailing and splicing of exons

**CO-3:** To study cracking the GC, Wobble hypothesis, Protein synthesis and stages of translation in prokaryotes and eukaryotes

**CO-4:** To study the gene regulation in prokaryotes and eukaryotes, operon models, and other accessory proteins involved in it

**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Fundamentals of Molecular Biology	Veer Bala Rastogi	Anne Book Publisher. 2010
Cell and Molecular Biology: Concepts and Experiments. VI Edition.	Karp, G. (2010).	John Wiley & Sons. Inc.
Molecular Biology of the Gene (VI Edition.).	Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008)	Cold Spring Harbour Lab. Press, Pearson Pub.

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**Course Name:** Molecular Biology Practical

**Course Code:** SSBT2120

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to develop skills for preparation of solutions for molecular biology. The students also learn the steps for isolation, verification as well as quantification of nucleic acids.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Preparation of solutions for Molecular Biology experiments.	06
2.	Isolation of chromosomal DNA from bacterial cells.	06
3.	Isolation of Plasmid DNA by alkaline lysis method	06
4.	Agarose gel electrophoresis of genomic DNA	06
5.	Isolation of Yeast genomic DNA	12
6.	Isolation of Plant genomic DNA	12
7.	DNA estimation by Diphenylamine method	06
8.	RNA Estimation by Orcinol method	06

**Course outcome:**

**CO-1:** To learn the preparation and importance of molecular biological buffers

**CO-2:** To gain knowledge about isolation of Genomic and plasmid DNA from Prokaryotic as well as Eukaryotic cell

**CO-3:** To learn how DNA samples are analysed by agarose gel electrophoresis

**CO-4:** To learn about quantitative measurement of DNA and RNA

**Reference Books:**

Title	Authors	Publisher
Fundamentals of Molecular Biology	Veer Bala Rastogi	Anne Book Publisher. 2010
Cell and Molecular Biology: Concepts and Experiments. VI Edition.	Karp, G. (2010).	John Wiley & Sons. Inc.
Molecular Biology of the Gene (VI Edition.).	Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008)	Cold Spring Harbour Lab. Press, Pearson Pub.



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**Course Name:** Enzymology I

**Course Code:** SSBT2140

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

This course is designed to enable students to acquire basic understanding of enzymes, enzyme action, catalysis and their inhibition.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>AN INTRODUCTION TO ENZYMES</b> Historical aspect of enzymes, Enzymes: Nomenclature & classification, Structural and functional aspects of enzymes (Primary, secondary and tertiary structures).	6	20
2	<b>ENZYMES: NATURE &amp; CHARACTERS</b> Chemical nature of enzymes, Characteristics of enzymes, Enzyme working: catalytic power and specificity.	9	30
Section-II			
3	<b>ENZYMES TYPES AND ACTIVE SITE</b> Monomeric and oligomeric enzymes, Active site: features and Theories (lock and key, induce fit theory), Enzyme immobilization and uses.	6	20
4	<b>SPECIFICITY OF ENZYME ACTION &amp; INHIBITION</b> Types of specificity, Enzyme Inhibition: competitive, uncompetitive, non-competitive, Biological role of enzymes	9	30

**Course outcome:**

**CO-1:** To acquire knowledge about history of enzyme, enzyme nomenclature and classification

**CO-2:** To get knowledge of enzymes' chemical nature characteristics

**CO-3:** To know about characteristics of monomeric and oligomeric enzymes and enzyme substrate interaction

**CO-4:** To get knowledge of different types of enzyme specificity and inhibition

**Reference Books:**

Title	Authors	Publisher
Enzymes: Biochemistry, Biotechnology, Clinical Chemistry. 2 <sup>nd</sup> Edition.	Trevor Palmer and Philip Bonner.	East-West Press Private Limited.
Lehninger: Principles of Biochemistry. 7 <sup>th</sup> edition.	David L. Nelson and Michael M. Cox.	W H Freeman.

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**Course Name:** Enzymology II

**Course Code:** SSBT2160

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to enable students to acquire knowledge of enzymatic catalysis, their mechanism of action, enzymatic kinetics as well as regulatory enzymes.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>CATALYTIC ACTIVITY</b> Theories: Collision theory, activation energy and transition state theory. Catalysis.	6	20
2	<b>ENZYME KINETICS</b> Relationship between initial velocity & substrate concentration, Michaelis-Menton equation and its significance, Lineweaver –Burk plot/equation.	9	30
Section-II			
3	<b>ENZYMATIC REACTIONS MECHANISMS</b> Chymotrypsin mechanism including acylation and deacylation, Enolase reaction mechanism using metal ions, Hexokinase undergoing induce fit on substrate binding.	9	30
4	<b>REGULATORY ENZYMES</b> Introduction to Regulatory Enzymes, Allosteric enzymes and kinetics properties, Enzyme regulation by proteolytic cleavage, covalent modification and phosphoryl group transfer	6	20

**Course outcome:**

**CO-1:** To acquire knowledge about activation energy, collision theory and transition state

**CO-2:** To derive MM equation, L-B Plot and understand the significance of Km and Vmax

**CO-3:** To study the conversion of substrate to product with the examples of chymotrypsin, enolase and hexokinase enzyme.

**CO-4:** To get knowledge of allosteric enzymes and regulatory mechanisms.

**Reference Books:**

Title	Authors	Publisher
Enzymes: Biochemistry, Biotechnology, Clinical Chemistry. 2 <sup>nd</sup> Edition.	Trevor Palmer and Philip Bonner.	East-West Press Private Limited.
Lehninger: Principles of Biochemistry. 7 <sup>th</sup> edition.	David L. Nelson and Michael M. Cox.	W H Freeman.

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**Course Name:** Enzymology Practical

**Course Code:** SSBT2180

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to apply their knowledge for screening of enzyme producing microbes, purification and optimization of enzymes as well as understanding role of enzymes in industry

**Course Contents:**

Section-I		
Module	Content	Hours
1	Screening of amylase enzyme producing microbes	06
2.	Screening of cellulase enzyme producing microbes	06
3.	Screening of protease enzyme producing microbes	06
4.	Screening of lipase enzyme producing microbes	06
5.	Effect of pH on amylase enzyme activity	06
6.	Effect of Temperature on amylase enzyme activity	06
7.	Effect of substrate concentration on amylase enzyme activity	06
8.	Effect of metal ions on amylase enzyme activity	06
9.	Purification of amylase enzyme by Ammonium sulphate& Dialysis	12

**Course outcome:**

**CO-1:** To learn the methods to grow, culture and screen various different enzyme producing microbes

**CO-2:** To learn to determine optimum temperature, pH, substrate concentration etc. for the maximum activity of an enzyme

**CO-3** To isolate and purify enzymes from various sources

**CO-4:** To understand the role of various enzymes in different industries

**Reference Books:**

Title	Authors	Publisher
Enzymes: Biochemistry, Biotechnology, Clinical Chemistry. 2 <sup>nd</sup> Edition.	Trevor Palmer and Philip Bonner.	East-WestPress Private Limited.
Lehninger: Principles of Biochemistry. 7 <sup>th</sup> edition.	David L. Nelson and Michael M. Cox.	W H Freeman.

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**Course Name:** Introduction to Bio-industries

**Course Code:** SSBT2240

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will acquire the fundamental knowledge of various Bio-Industries like food, chemical, pharmaceutical, agriculture-based industries etc. and its application in the field of biotechnology

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Food Based Industries</b> A visit to Food based industry and acquaintance with instruments/ equipment's/ processes/ technology employed.	6	20
2	<b>Pharmaceutical Industries</b> A visit to Pharmaceutical industry and acquaintance with instruments/ equipment's/ processes/ technology employed.	9	30
Section-II			
3	<b>Agriculture/Dairy based Industries</b> A visit to Agriculture based industry and acquaintance with instruments/ equipment's/ processes/ technology employed.	9	30
4	<b>Chemical Industries</b> A visit to Chemical industry and acquaintance with instruments/ equipment's/ processes/ technology employed	6	20

**Course outcome:**

**CO-1:** To understand the various operations involved in venture creation

**CO-2:** To acquire the knowledge of the production and quality, manufacturing ideas, new processes and bioengineering with innovation

**CO-3:** To determine the market value of the different bio product and identify scope for entrepreneurship in biosciences

**CO-4:** To understand complex processes on different scales, used to multidisciplinary approaches

**Reference Books:**

Title	Authors	Publisher
Seven Crisis of Business Strategies for Survival & Growth	V.G.Patel	EDI Ahemdabad
"Small Business Management	Ramchandran	Himalaya Publication

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**Course Name:** German II (Foreign Language)

**Course Code:** CFLS3021

**Prerequisite Course/s:** CFLS3010 Communication Skills (Foreign Language) German

**Teaching & Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
1	1	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Exam

**Introduction & Objective of the Course:**

1. To develop and integrate the use of the four Language skills i.e. listening, speaking, reading and Writing.
2. To use the language effectively and appropriately on topics of everyday life situations.
3. To develop an interest in the appreciation of French.
4. To develop an intercultural awareness.
5. To enhance the ability of the candidates to express their ideas and feelings in their own words and for them to understand the use of correct language.
6. To appreciate the language as an effective means of communication.
7. To understand language when spoken at normal conversational speed in everyday life situations.
8. To understand the basic structural patterns of the language, vocabulary and constructions.

Section I - Theory			
Unit	Content	Hours	Weightage
1.	Introduction to German <ul style="list-style-type: none"> <li>• Alphabets</li> <li>• German accents</li> <li>• German Numbers</li> <li>• What are the similarities and differences between English and German?</li> <li>• Greetings</li> </ul>	10	20%
2.	German Time <ul style="list-style-type: none"> <li>• Basic Introduction</li> </ul>	5	25%
3.	Vocabulary part-1 <ul style="list-style-type: none"> <li>• The days of the week</li> <li>• The months of the year</li> <li>• Seasons 2 05</li> <li>• Directions &amp; Weather</li> </ul>	5	25%
4.	Vocabulary part-2 <ul style="list-style-type: none"> <li>• Family</li> <li>• Colors and Shapes</li> <li>• Day/time indicators</li> <li>• Body parts</li> <li>• Clothing</li> </ul>	10	30%

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**Outcome(s):**

After completion of the course, the student will be able to

- Demonstrate the level of proficiency necessary to enable them to function in an environment where French is used exclusively.
- Demonstrate speaking, listening, reading, and writing in French.
- Delf exam certification will be valid throughout the world.

**Textbook(s):**

<b>Title</b>	<b>Author/s</b>	<b>Publication</b>
Nameste German G.MAUGER MON LIVRE FRANCAIS	Yoshita dalal	9 seeries publications
DEL F A1	Bruno Giraedeau Nelly Mous	Goyal publishers

**Web Material/Links:**

- Ciep.com
- [www.youlearnfrench](http://www.youlearnfrench)

**Course Evaluation:**

Based on the exam.

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**Course Name:** Integrated Personality Development Course 2 (IPDC-2)

**Course Code:** SEPD3050

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	1	100	00	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To help learners to

- provide students with a holistic education – focused on increasing their intelligence quotient, physical quotient, emotional quotient and spiritual quotient
- provide students with hard and soft skills, making them more marketable when entering the workforce
- educate students on their social responsibilities as citizens of India
- provide students with a value-based education which will enable them to be successful in their family, professional, and social relationships.
- teach self-analysis and self-improvement exercises to enhance the potential of the participants.

**Course Contents:**

Lecture No.	Content	Hours
1.	Remaking Yourself - Restructuring Yourself	02
2.	Essentials of Profession -Writing A Resume	02
3.	Financial Wisdom -Basics of Financial Planning.	02
4.	Financial Wisdom -Financial Planning Process.	02
5.	From House To Home -Listening & Understanding.	02
6.	From House To Home -Forgive & Forget.	02
7.	From House To Home -Bonding The Family.	02
8.	Soft Skills-Networking, Decision making & Leadership	02
9.	Soft Skills-Teamwork, Harmony & Adaptability	02
10.	Mass Management –ProjectManagement	02
11.	My India My Pride -Glorious Past(Part -1)	02
12.	My India My Pride -Glorious Past(Part -2)	02
13.	My India My Pride –Present Scenario.	02
14.	My India My Pride -An Ideal Citizen-1	02
15.	My India My Pride -An Ideal Citizen-2	02

**Course Evaluation:**

**Theory:**

- Continuous Evaluation consists of 40 marks. There will be a mid-term exam which will assess the current progress of students, it assessed out of 20 marks and will be equivalent to 20 marks of the Continuous Course Evaluation (CCE). There will be a submission consisting 10 marks as per the guidelines of course coordinator and average of the attendance consisting 10 marks (minimum 60 percentage attendance is required).
- End semester exam (ESE) part A 30 marks and part B 30 marks.



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**Course Outcome(s):**

After completing the IPDC course (lecture and full participation in activities/challenges), we would like to see PPSU students:

- To have gained a greater sense of social responsibility
- To have gained marketable hard and soft skills that would directly apply to their future careers
- To have gained greater insight and ability to navigate their family, social, and professional relationships along with difficult situations which may arise in their life
- To have a broader sense of self-confidence and a defined identity
- To have greater value for living a moral and ethical life based on principles taught in the course

**Sem-5**

PPSU

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**Course Name:** Plant Biotechnology I

**Course Code:** SSBT3010

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will acquire the fundamental knowledge about Plant tissue culture, Transformation techniques and role of plant via this course

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Plant Tissue Culture:</b> Introduction and application of plant tissue culture- Totipotency; Tissue culture media (Inorganic nutrients, carbon sources, vitamins, organic supplement and gelling agent); Plant hormones and regulators	9	30
2	<b>Types of Culture</b> Seed culture, embryo culture, root culture, organ culture (Nucellus& endosperm culture), cell culture, protoplastculture	6	20
Section-II			
3	<b>Micropropagation</b> Meristem & shoot tip culture, Bud culture, organogenesis, Embryogenesis, Advantage of micro propagation and limitation <b>Haploid production</b> Anther culture, microspore culture, significance and uses of haploid, problems, Embryo culture and embryo rescue techniques; Ovule, ovary culture and endosperm culture; Artificial seeds	6	20
4	<b>Protoplast culture, Somatic hybridization&amp;Somaclonal variation-</b> Protoplast isolation, protoplast development, somatic hybridization, protoplast fusion, identification and selection of hybrids, verification of somatic hybrids, cybrids, potential of somatic hybridization, problem and limitation of somatic hybridization, Basis of Somaclonalvariation, application and disadvantages of Somaclonal variation, Gametoclinal variation	9	30

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**Course outcome:**

**CO-1:** To acquire knowledge of components of plant tissue culture media and their uses

**CO-2:** Knowledge of different types of culture with their application

**CO-3:** To Understand different steps of micropropagation, haploid production and also know about artificial seed production.

**CO-4:** Knowledge of Protoplast culture, Somatic hybridization and Somaclonal variation

**Reference Books:**

Title	Authors	Publisher
Introduction to Plant Biotechnology	H.S.Chawla	Oxford publishing, 3rd edition
Plant Tissue Culture: an Introductory Text,	Bhojwani and Dantu, (2013).	Springer, New Delhi.
Plant Tissue Culture-Theory and Practice.	Bhojwani, S.S and Razdan. M.K. (2009).	Elsevier India Pvt. Ltd.
Plant Tissue Culture, Development and Biology - <a href="http://www.ebook777.com/plant-tissue-culture-development-biotechnology/">http://www.ebook777.com/plant-tissue-culture-development-biotechnology/</a>		

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**Course Name:** Plant Biotechnology –II

**Course Code:** SSBT3030

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
3	0	0	3	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to know about transient and stable expression system, gene transfer methods, development of transgenic crops for crop improvement and development of transgenic crops for quality improvement

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Gene transfer in plants Transient and stable expression</b> <b>Reporter gene</b> (opine synthase, chloramphenicol acetyl transferase, Beta luciferase, Bacterial luciferase, Firefly luciferase, GFP, anthocyanin) <b>Selectable Marker</b> (antibiotic resistant markers, antimetabolite resistance markers, herbicide resistance marker)	9	20
2	<b>Gene transfer methods:</b> <b>Vector mediated transfer</b> Agrobacterium mediated method – Agrobacterium biology; Ti plasmid-based transformation; crown gall and hairy root disease, Ti and Ri plasmids, T-DNA genes, and Ti plasmid virulence genes and their functions, vir gene induction, mechanism of T-DNA transfer, Caulimoviruses, gemini viruses, RNA viruses <b>Vector less Transfer</b> Physical (Electroporation, Microprojectiles, Macroinjection, microinjection, liposome) and chemical method (PEG, Calcium phosphate, DMSO)	14	35
Section-II			
3	<b>Transgenics in Crop Improvement</b> Resistance to abiotic stress (Insect resistance, virus resistance, disease resistance, Resistance to Abiotic stress, Resistance to Herbicide)	12	25

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4	<b>Transgenic plants for quality</b> Improved storage, longer life, flower color & shape, malesterility <b>Transgenic plant as bioreactor:</b> Carbohydrates Lipids Protein quality Enzymes Vitamin and mineral Biodegradable plastic Edible Vaccine Platibodies Pharmaceutical important proteins	10	20
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**Course outcome:**

**CO-1:** Knowledge of about different reporter genes and selectable markers used in plant transgenic research

**CO-2:** Knowledge of about different methods of gene transfer (vector and vector less mediated)

**CO-3:** Knowledge of development of transgenic crops for biotic and abiotic stress tolerance

**CO-4:** Knowledge of development of transgenic crops for quality (improved storage, longer life, male sterility) and of biodegradable plastics, edible vaccine, plantibodies.

**Reference Books:**

Title	Authors	Publisher
Introduction to Plant Biotechnology	H.S.Chawla	Oxford publishing, 3rd edition
Plant Tissue Culture: an Introductory Text,	Bhojwani and Dantu, (2013).	Springer, New Delhi.
Plant Tissue Culture-Theory and Practice.	Bhojwani, S.S and Razdan. M.K. (2009).	Elsevier India Pvt. Ltd.
Plant Tissue Culture, Development and Biology - <a href="http://www.ebook777.com/plant-tissue-culture-development-biotechnology/">http://www.ebook777.com/plant-tissue-culture-development-biotechnology/</a>		

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**Course Name:** Plant Biotechnology Practical

**Course Code:** SSBT3050

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

This course is designed to understand basics of sterilization in Plant Tissue Culture, learn about various explants, learn about Protoplast isolation and fusion and to get acquainted with basics of Micropropagation stages

**Course Contents:**

Section-I		
Module	Content	Hours
1	Preparation of Murashige and Skoog (MS) medium	10
2.	Surface sterilization of explants	10
3.	Development of callus culture	10
4.	Isolation of protoplast from different plant	10
5.	Protoplast fusion by different methods	10
6.	Micro-propagation of vegetatively grown plant	10

**Course outcome:**

**CO-1:** To know about various sterilizing agent like sodium hypochlorite, mercuric chloride, fungicides and their mechanism of action

**CO-2:** To understand about selection and excision of various explants like nodes, leaves, buds, rhizome, roots etc. from mother plant

**CO-3:** To know mechanical and enzymatic protoplast isolation methods

**CO-4:** Basic understanding about various stages of micropropagation in tobacco explant which includes explant selection, initiation, shoot multiplication, rooting and hardening processes.

**Reference Books:**

Title	Authors	Publisher
Introduction to Plant Biotechnology	H.S.Chawla	Oxford publishing, 3rd edition
Plant Tissue Culture: an Introductory Text,	Bhojwani and Dantu, (2013).	Springer, New Delhi.
Plant Tissue Culture-Theory and Practice.	Bhojwani, S.S and Razdan. M.K. (2009).	Elsevier India Pvt. Ltd.
Plant Tissue Culture, Development and Biology - <a href="http://www.ebook777.com/plant-tissue-culture-development-biotechnology/">http://www.ebook777.com/plant-tissue-culture-development-biotechnology/</a>		

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**Course Name:** Animal Biotechnology I

**Course Code:** SSBT3070

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will acquire the fundamental knowledge about animal cell culture, cell cloning, and other different techniques

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Introduction to Techniques</b> Historical Background, Advantages of Tissue Culture, Limitations, Types of Tissue Culture, The Culture Environment, Proliferation, Differentiation	6	20
2	<b>Development of Media</b> Physicochemical Properties, Complete Media, Serum and Supplements	9	30
Section-II			
3	<b>Serum-Free Media</b> Disadvantages of Serum, Advantages of Serum-Free Media, Disadvantages of Serum-Free Media, Replacement of Serum, Selection of Serum-Free Medium, Development of Serum-Free Medium, Preparation of Serum-Free Medium, Protein-Free Media	9	30
4	<b>Primary Culture</b> Types of Primary Cell Culture, Isolation of The Tissue- Mouse Embryo, Chick Embryo, Human Biopsy Material; Primary Culture, Subculture and Propagation, Cell Line Designations, Choosing A Cell Line , Routine Maintenance , Commonly used cell lines, Subculture	6	20

**Course outcome:**

**CO-1:** To learn Proliferation, Differentiation, Culture Environment as well as the Advantages and Limitations of Tissue Culture

**CO-2:** To acquire knowledge about Physicochemical Properties, Complete Media, Serum and supplements

**CO-3:** To acquire knowledge about Development and preparation of Serum-Free Medium

**CO-4:** To acquire knowledge about isolation of The Tissue, Primary Culture, Subculture, Propagation and Cell Line Designations

**Reference Books:**

Title	Authors	Publisher
Textbook of animal biotechnology	B Singh, S K Gautam and M S Chauhan	ISBN13: 9788179933275. <b>Publisher:</b> Teri Press



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Animal Biotechnology 1st Edition- Models in Discovery and Translation.	AshishVermaAnchal Singh	AcademicPress; 1 <b>edition</b> (December24,2013)
Biotechnology-expanding horizons	B.D. Singh	Kalyani
Culture of Animal cells	Ian Freshney	Willey press, 5 <sup>th</sup> edition

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**Course Name:** Animal Biotechnology II

**Course Code:** SSBT3090

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
3	0	0	3	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to discuss the process of cloning and expression of gene and other techniques in genetic engineering & Biotechnology To learn basics of culture media preparation, conditioned media and applications. To learn basic concepts and principles of cell separation techniques To learn basic concept of cell differentiation, proliferation and transformation

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Cloning and Selection</b> Cell Cloning, Conditions That Improve Clonal Growth, Conditioned Medium, Feeder Layers, Suspension Cloning, Isolation of Clones, Replica Plating, Selective Inhibitors, Isolation of Genetic Variants, Interaction with substrate	9	20
2	<b>Cell Separation</b> Antibody-Based Techniques, Immune Panning, Magnetic Sorting, Fluorescence-Activated Cell Sorting <b>Characterization</b> The Need for characterization, Cell Morphology, Chromosome Content, DNA Content, RNA and Protein Expression, Enzyme Activity, Antigenic Markers	14	35
Section-II			
3	<b>Differentiation</b> Stages of Differentiation, Proliferation and Differentiation, Markers of Differentiation, Induction of Differentiation <b>Transformation</b> What Is Transformation, Genetic Instability, Immortalization,	12	25
4	<b>Cryopreservation</b> Rationale For Freezing, Acquisition of Cell Lines For Cryopreservation, Principles of Cryopreservation <b>Quantitation</b>	10	20

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	Cell Counting, Cell Weight, DNA Content, Protein, Rates of Synthesis, Cytometry, Cell Proliferation <b>Cytotoxicity</b> Viability, Toxicity, and Survival, In Vitro Limitations, Nature of The Assay, Applications of Cytotoxicity Assays		
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**Course outcome:**

**CO-1:** To learn Cell Cloning, Selection and isolation of Genetic Variants.

**CO-2:** To learn Cell separation and characterization.

**CO-3:** To learn cell differentiation and transformation techniques.

**CO-4:** To learn cryopreservation, cell quantification and cytotoxicity

**Reference Books:**

Title	Authors	Publisher
Textbook of animal biotechnology	B Singh, S K Gautam and M S Chauhan	ISBN13: 9788179933275. <b>Publisher:</b> Teri Press
Animal Biotechnology 1st Edition- Models in Discovery and Translation.	AshishVermaAnchal Singh	AcademicPress; <b>1 edition</b> (December24,2013)
Biotechnology-expanding horizons	B.D. Singh	Kalyani
Culture of Animal cells	Ian Freshney	Willey press, 5 <sup>th</sup> edition

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**Course Name:** Animal Biotechnology Practical

**Course Code:** SSBT3110

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to introduce learning, handling and setup of an cell culture laboratory, sterilization methods, cell line handling and basics of Cryopreservation techniques

**Course Contents:**

Section-I		
Module	Content	Hours
1	Design and layout of cell culture laboratory	05
2.	General laboratory rules	05
3.	Aseptic techniques – sterilization methods	10
4.	Preparation and sterilization of media	10
5.	Selection of animal cell line	10
6.	Quantitation techniques	10
7.	Cryo preservation techniques	10

**Course outcome:**

**CO-1:** To Maintain Cell culture lab

**CO-2:** To learn application of various Sterilization methods for disinfection

**CO-3:** To handle and maintain cell line cultures for biological assays

**CO-4:** To learn use of cryopreservation to maintain and preserve cell culture and cell line

**Reference Books:**

Title	Authors	Publisher
Textbook of animal biotechnology	B Singh, S K Gautam and M S Chauhan	ISBN13: 9788179933275. <b>Publisher:</b> Teri Press
Animal Biotechnology 1st Edition- Models in Discovery and Translation.	AshishVermaAnchal Singh	AcademicPress; <b>1edition</b> (December24,2013)
Biotechnology-expanding horizons	B.D. Singh	Kalyani
Culture of Animal cells	Ian Freshney	Willey press, 5 <sup>th</sup> edition

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**Course Name:** Recombinant DNA Technology I

**Course Code:** SSBT3130

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to understand Basic Techniques of r-DNA technology, study Enzymes for Gene Cloning, learn Vectors used in gene cloning and learn Vectors with big insert size like BAC, YAC and PAC.

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Basic Techniques of r-DNA technology</b> Introduction, History, Definitions, basic steps of gene cloning and rDNA technology, the tools used in gene cloning and rDNA Technology	6	20
2	<b>Enzymes for Gene Cloning</b> Restriction Endonucleases and their types, Joining DNA molecules: Ligase, DNA modifying enzymes: Kinase, Alkaline phosphatase, Terminal transferase, DNA polymerase, S1 nuclease, Exonuclease, Linkers and Adapters	9	30
Section-II			
3	<b>Gene cloning: vector-I</b> Properties of vector, cloning and expression vector, Biology of <i>E.coli</i> K12 vector, Plasmid vector, pBR322, pUC18/19, pGEN3Z, Yeast Plasmid vector (yeast integrating plasmid, episomal plasmid, replicating plasmid, centromeric plasmid, linear plasmid), Ti plasmid, cosmids, Phagemid vector	9	30
4	<b>Gene cloning: vector-II</b> Biology of Bacteriophage vector, $\lambda$ gt10, $\lambda$ gt11, EMBL3 & 4, M13 phage vector, YAC, BAC, P1 phage vector, PAC, Transposon, Shuttle vector, Vector for plant, Vector for animal	6	20

**Course outcome:**

**CO-1:** To learn the concepts and the tools used in gene cloning and rDNA Technology

**CO-2:** To study the different types of enzymes and their catalyzed reactions

**CO-3:** To study the basic vectors used in gene cloning and to construct vector maps

**CO-4:** To learn and study vectors which can take up inserts more than 1-2Kb

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**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Gene Cloning and DNA Analysis. 5th edition.	Brown TA. (2006).	Blackwell Publishing, Oxford, U.K.
Biotechnology-Applying the Genetic Revolution.	Clark DP and Pazdernik NJ. (2009).	Elsevier Academic Press, USA.
Molecular Biotechnology- Principles and Applications of recombinant DNA.	Glick, B.R., Pasternak, J.J. (2003).	ASM Press, Washington
Principles of Gene Manipulation and Genomics, 7 <sup>th</sup> edition.	Primrose SB and Twyman RM. (2006).	Blackwell Publishing, Oxford, U.K.
Molecular Cloning-A Laboratory Manual. 3 <sup>rd</sup> edition	Sambrook J, Fritsch EF and Maniatis T. (2001).	Cold Spring Harbor Laboratory Press.

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**Course Name:** Recombinant DNA Technology II

**Course Code:** SSBT3150

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To understand the construction of cDNA library, study construction of genomic library, learn screening of recombinant clones using conventional techniques and to learn screening of recombinant clones using advanced techniques

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Construction of cDNA library</b> Isolation of mRNA, preparation of cDNA, cloning of cDNA, Problem on CDNA preparation, Properties of cDNA and cDNA libraries, application of cDNA libraries, introduction of host cells, clone selection	6	20
2	<b>Construction of Genomic library</b> Isolation of DNA, Partial digestion, ligation of fragment to a vector, amplified genomic library, subgenomic libraries	9	30
Section-II			
3	<b>Screening of clones-I</b> Probes, colony and plaque hybridization, immunological, detection, southern blot analysis, chromosome walking, screening by PCR, Nick translation, Random primed	9	30
4	<b>Screening of clones-II</b> Non-radioactive labelling, Horseradish peroxidase system, DIG, Biotin-streptavidin, Microarray technology, DNA, sequencing-Sanger, Maxam-gilbert, NGS	6	20

**Course outcome:**

**CO-1:** To understand fundamental knowledge about r-DNA technology and application of cDNA libraries, introduction of host cells and clone selection

**CO-2:** To learn isolation of DNA, Partial digestion, ligation of fragment to a vector, amplified genomic library, sub-genomic libraries

**CO-3:** To learn Plaque hybridization, immunological detection, southern blot analysis, chromosome walking, screening by PCR and Nick translation

**CO-4:** To understand Non-radioactive labeling, Horseradish peroxidase system, DIG, Biotin-streptavidin,

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Microarray technology, DNA sequencing-Sanger, Maxam-Gilbert and NGS

**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Gene Cloning and DNA Analysis. 5th edition.	Brown TA. (2006).	Blackwell Publishing, Oxford, U.K.
Biotechnology-Applying the Genetic Revolution.	Clark DP and Pazdernik NJ. (2009).	Elsevier Academic Press, USA.
Molecular Biotechnology- Principles and Applications of recombinant DNA.	Glick, B.R., Pasternak, J.J.(2003).	ASM Press, Washington
Principles of Gene Manipulation and Genomics, 7 <sup>th</sup> edition.	Primrose SB and Twyman RM.(2006).	Blackwell Publishing, Oxford, U.K.
Molecular Cloning-A Laboratory Manual. 3 <sup>rd</sup> edition	Sambrook J, Fritsch EF and Maniatis T. (2001).	Cold Spring Harbor Laboratory Press.



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**Course Name:** Recombinant DNA Technology Practical

**Course Code:** SSBT3170

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will acquire the fundamental knowledge of cloning and tools used in r-DNA technology

**Course Contents:**

Section-I		
Module	Content	Hours
1	Isolation of chromosomal DNA from organisms	10
2.	DNA molecular size determination	10
3.	Restriction digestion of DNA	10
4.	DNA ligation method	10
5.	Transformation of competent cells by Blue-white screening methods	10
6.	Optimization of PCR methods	10

**Course outcome:**

**CO-1:** To learn the basic techniques to isolate DNA and to learn reagent preparation

**CO-2:** To recognize the different types of REs, pattern in gel, to learn reaction mixture components required for restriction digestion and ligation reactions.

**CO-3:** To study and learn about the various screening techniques with special mention to blue-white screening, know about IPTG, X-GAL and X-Gluc

**CO-4:** To set a PCR machine by preparing the individual reagents and mix them in appropriate concentration, fix temperature profile and about Taq polymerase

**Reference Books:**

Title	Authors	Publisher
Gene Cloning and DNA Analysis. 5th edition.	Brown TA. (2006).	Blackwell Publishing, Oxford, U.K.
Biotechnology-Appling the Genetic Revolution.	Clark DP and Pazdernik NJ. (2009).	Elsevier Academic Press, USA.
Molecular Biotechnology- Principles and Applications of recombinant DNA.	Glick, B.R., Pasternak, J.J. (2003).	ASM Press, Washington
Principles of Gene Manipulation and Genomics, 7 <sup>th</sup> edition.	Primrose SB and Twyman RM.(2006).	Blackwell Publishing,Oxford, U.K.
Molecular Cloning-A Laboratory Manual. 3 <sup>rd</sup> edition	Sambrook J, Fritsch EF and Maniatis T. (2001).	Cold Spring HarborLaboratory Press.

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**Course Name:** Microbial Biotechnology I

**Course Code:** SSBT3190

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will acquire the fundamental knowledge about strain improvement, industrially important microbes

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Industrially Important Microbes</b> Bacteria, Algae, Fungi	6	20
2	<b>Isolation of Industrially Important Microbes</b> Isolation methods, screening methods sterilization and disinfection methods, culture methods	9	30
Section-II			
3	<b>Strain Improvement</b> General, Mutation, Recombination in fungi, bacteria and actinomycetes (Parasexual cycle, Protoplast fusion), Regulation, Gene technology, use of Genetic methods	6	20
4	<b>Preservation of Industrially Important Microbes</b> Storage at reduced temperature, on agar slope, under liquid nitrogen, storage at dehydrated form, dried culture, lyophilisation, quality control of preserved stock culture	9	30

**Course outcome:**

**CO-1:** To develop knowledge about why and which microorganisms are used at Industrial level.

**CO-2:** To learn how isolation is done of industrially important microorganisms

**CO-3:** To learn how microbial strains can be improved by genetic methods

**CO-4:** To learn how preservation is done for industrially important microorganisms

**Reference Books:**

Title	Authors	Publisher
Biotechnology expanding horizons	B.D.Singh	5 <sup>th</sup> edition, 2012, kalyani publication
Elements of Biotechnology	P.K.Gupta	Rastogi publication 2 <sup>nd</sup> edition
A textbook of Industrial Microbiology	W.Crueger and A. Crueger	Panima publishing, 2005
Principles of Fermentation technology	Whitaker, allan; stanbury, peter & Hall, stephen	Butterworth-heinemann-elsevier, 2008

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**Course Name:** Microbial Biotechnology II

**Course Code:** SSBT3210

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To impart the knowledge of industrially important microbes and the production process of various metabolites used for the production of amino acids, vitamins, provide information about process as well as industrially important microbes for antibiotics, single-cell protein and organic solvent production

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Production of Organic acid and amino acids:</b> Introduction Citric acid, gluconic acid, acetic acid, lactic acid, kojic acid, L-Glutamic acid, L-lysine, L-tryptophan	6	20
2	<b>Production of Vitamins:</b> Introduction, Vit-B12, Riboflavin, $\beta$ -Carotene	9	30
Section-II			
3	<b>Production of Antibiotics:</b> $\beta$ -lactam, Tetracycline, anthracycline, aromatic, nucleoside antibiotic, other commercial antibiotic	6	20
4	<b>Production of other metabolites and SCP:</b> Butanol-Acetone, ethanol, Spirulina, Mushroom, advantages and disadvantages of SCP	9	30

**Course outcome:**

**CO-1:** To learn about the process of large scale Production of Organic acid and amino acids

**CO-2:** To learn basic knowledge about the fermentation conditions for the microbial synthesis of vitamins needed in the form of neutra and pharmaceuticals.

**CO-3:** To recognize and optimize the antibiotic-producing actinomycetes

**CO-4:** To understand the microbial routes for the synthesis of acetone, butanol, and the importance of algae and fungi as a single cell protein and neutraceuticals

**Reference Books:**

Title	Authors	Publisher
Biotechnology expanding horizons	B.D.Singh	5 <sup>th</sup> edition, 2012, kalyani publication
Elements of Biotechnology	P.K.Gupta	Rastogi publication 2 <sup>nd</sup> edition
A text book of Industrial Microbiology	W.Crueger and A. Crueger	Panima publishing, 2005
Principles of Fermentation technology	Whitaker, allan; stanbury, peter & Hall, stephen	Butterworth-heinemann-Elsevier, 2008

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**Course Name:** Microbial Biotechnology Practical

**Course Code:** SSBT3230

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To isolate industrially important microbes, screen antibiotic-producing actinomycetes, screen out penicillin and ethanol-producing fungi and yeast from the environment and to optimize the production and estimation of the production of metabolites.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Antibiotic producing microbes by crowded plate techniques	10
2.	Antibiotic producing microbes by Wilkin's techniques	10
3.	Isolation of organic acid producing microbes	10
4.	Ethanol estimation and production by yeast	10
5.	Bioassay of penicillin by cup borer and paper disc method	10
6.	Isolation of industrially important microorganism from natural resource.	10

**Course outcome:**

**CO-1:** To identify, screen out the Antibiotic producing microbes

**CO-2:** To identify the actinomycetes for the production of antibiotics

**CO-3:** To differentiate between *Aspergillus* and *Penicillium*, their growing media, and optimization for penicillin.

**CO-4:** To modify the growing parameters for the industrially important strains

**Reference Books:**

Title	Authors	Publisher
Biotechnology expanding horizons	B.D.Singh	5 <sup>th</sup> edition, 2012, kalyani publication
Elements of Biotechnology	P.K.Gupta	Rastogi publication 2 <sup>nd</sup> edition
A text book of Industrial Microbiology	W.Crueger and A. Crueger	Panama publishing, 2005
Principles of Fermentation technology	Whitaker, allan; stanbury, peter & Hall, stephen	Butterworth-heinemann-Elsevier, 2008

**Sem-6**

PPSU

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**Course Name:** Environment Biotechnology I

**Course Code:** SSBT3080

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will acquire the fundamental knowledge about bioenergy, bioremediation and their application in fields

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Energy</b> Renewable and non-renewable energy sources. Conventional fuels and their environmental impact – Firewood, Plant, Animal, Water, Coal and Gas. Energy crops: Wood, sugar and starch crop, oil seed crops, hydrocarbon producing crops.	6	20
2	<b>Bioethanol</b> Advantages, production, ethanol recovery, future prospect <b>Biodiesel</b> Advantages, sources as lipid, production, present status <b>Biohydrogen</b> Anaerobic bacteria, photosynthetic algae <b>Biogas technology</b>	9	30
Section-II			
3	<b>Bioremediation</b> Principles of bioremediation, factors responsible for bioremediation, bioremediation strategies: <i>In situ</i> & <i>Ex situ</i> Microbial bioremediation, phytoremediation	9	30
4	<b>Special process</b> Bioleaching, Enrichment of ores by microorganisms (Gold, Copper and Uranium), Metal precipitation, Biopolymers: properties and its application, biopesticides, biofertilizers, composting, vermicompost, Environmental significance of genetically modified microbes, plants and animals.	6	20

**Course outcome:**

CO-1: To learn Renewable and non-renewable energy sources and knowledge of energy crops

CO-2: Knowledge of Bioethanol, biodiesel, biohydrogen and biogas technology

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CO-3: To understand bioremediation and aspects of Phytoremediation.

CO-4: Know about special processes like bioleaching, biopolymers and GMOs.

**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Biotechnology expanding horizons	B.D.Singh	5 <sup>th</sup> edition, 2012, Kalyani publication
Elements of Biotechnology	P.K.Gupta	Rastogi publication 2 <sup>nd</sup> edition

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**Course Name:** Environment Biotechnology II

**Course Code:** SSBT3100

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To learn about the various sources of waste.

To understand the difference between domestic and industrial wastes.

To know the ways and techniques to eradicate the pollutants present in environment.

To learn about the management of solid and liquid wastes

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Wastes and pollutants</b> Sources of wastes and pollutants, types of waste, hazards from wastes, scenario of waste, waste management	6	20
2	<b>Waste treatment</b> Physical method, chemical method, biological methods, biofilters, treatment of liquid waste, treatment of solid wastes, conventional solid waste management treatment, municipal solid waste management, Application of Biotechnology in waste treatment	9	30
Section-II			
3	<b>Wastewater treatment</b> Characteristics of wastewater, Aerobia wastewater treatment: activated sludge and oxidation pond, anaerobia waste water treatment:UASB and anaerobic baffled reactor	9	30
4	<b>Biodegradation of xenobiotics compounds</b> Types of xenobiotic compound, hazards from xenobiotics, hydrocarbon degradation, biodegradation of halogenated compound, origin of capacity to degrade xenobiotics, biotechnological approaches to degrade xenobiotics	6	20

**Course outcome:**

**CO-1:** Learn the various criteria of waste classification based on the toxicity

**CO-2:** Know the various aspects of wastewater. the difference between domestic wastes and the industrial effluents



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**CO-3:** Learn about the pollutants present in air, water and land. They will also learn about the In-situ and ex-situ conservation techniques

**CO-4:** Know about the various techniques and norms already employed to manage the wastes

**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Biotechnology expanding horizons	B.D.Sign	5 <sup>th</sup> edition, 2012, kalyani publication
Elements of Biotechnology	P.K.Gupta	Rastogi publication 2 <sup>nd</sup> edition

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**Course Name:** Environment Biotechnology Practical

**Course Code:** SSBT3120

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

This course is designed to test the quality of water by estimating BOD and COD, calculate the MPN in wastewater sample, identify the microbial growth in food sample and identify the microbial growth in raw milk sample.

**Course Contents:**

Section-I		
Module	Content	Hours
1	Calculation of Total Dissolved Solids (TDS) of water sample.	10
2.	Calculation of BOD of water sample.	10
3.	Calculation of COD of water sample.	10
4.	Bacterial Examination of Water by MPN Method.	10
5.	Microbiological analysis of food	10
6.	Microbiological analysis of milk	10

**Course outcome:**

**CO-1:** Analyzing the water sample by determining the amount of BOD and COD level and preliminary techniques to understand and estimate the quality of water sample.

**CO-2:** To identify the presence of microorganisms in the water sample.

**CO-3:** To check the presence of microorganisms in food samples and to understand the food spoiling microorganisms.

**CO-4:** To check the presence of microorganisms in milk samples and to understand the microorganisms involved in the spoilage of milk.

**Reference Books:**

Title	Authors	Publisher
Biotechnology expanding horizons	B.D.Singh	5 <sup>th</sup> edition, 2012, Kalyani publication
Elements of Biotechnology	P.K.Gupta	Rastogi publication 2 <sup>nd</sup> Edition

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**Course Name:** Bioinformatics

**Course Code:** SSBT3140

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To understand the history of Bioinformatics, and databases, understand the concepts of Protein Information Sources, PDB, SWISSPROT, TREMBL, understand Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly and Searching Databases

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>Introduction to Bioinformatics:</b> History of Bioinformatics. The notion of Homology. Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web.	6	20
2	Protein Information Sources, PDB, SWISSPROT, TREMBL, Understanding the structure of each source and using it on the web.	9	30
Section-II			
3	Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.	9	30
4	Searching Databases: SRS, Sequence Similarity Searches-BLAST, FASTA, Data Submission. Genome Annotation: Pattern and repeat finding, Gene identification tools.	6	20

**Course outcome:**

**CO-1:** To acquire the knowledge about basic of Bioinformatics

**CO-2:** To understand the Sequence Information Sources, such as EMBL, GENBANK, Entrez, etc.

**CO-3:** To learn about pairwise and multiple sequence analysis and phylogenetic analysis

**CO-4:** To learn Pairwise Alignments using BLAST, and interpretation of its result

**Reference Books:**

Title	Authors	Publisher
Bioinformatics: Principles and Applications.	Ghosh Z. and Bibekanand M.	Oxford University Press. (2008)
Bioinformatics and Functional Genomics. II Edition.	Pevsner J.	Wiley-Blackwell. (2009)

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**Course Name:** Intellectual Property Right

**Course Code:** SSBT3160

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The students will acquire the fundamental knowledge about biotechnology entrepreneurship, intellectual property rights, breeders rights, patent policy

**Course Contents:**

Section-I			
Module	Content	Hours	Weightage (%)
1	<b>IPR</b> Introduction, history, world organization, IPR in INDIA, Forms of protection: copy right, trademark, geographical indication, trade secret, designs, layout design of integrated circuits, patent	6	20
2	<b>Patent</b> Patent application, international patenting revocation of patent, patenting of biological material: microorganisms, plant patent, animal patent, genes & DNA patent, cloning patent, biological compounds, broad patent of Biotechnology	9	30
Section-II			
3	Plant Breeders right UPOV, function of UPOV, breeders exemption, farmers privilege, plant variety protection in India, farmer's right, advantages of PBR, Disadvantages of PBR	9	30
4	Case studies on plant patents Patenting of basmati rice in USA, revocation of turmeric patent, revocation of neem patent	6	20

**Course outcome:**

**CO-1:** Understand the basic differences between copyrights, designs, patents, GI, etc. In addition to this, to know the various procedures and forms available for patent application in India

**CO-2:** To learn which biological material and under what conditions are patentable?

**CO-3:** Knowledge on plant protection and plant breeders right, Acts and governing bodies for the PBR including India.

**CO-4:** Identify the the process of revocation of patents after grant by taking case studies especially Basmati rice, turmeric, etc.

**P P Savani University**  
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Syllabus, Teaching and Examination Scheme

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**Reference Books:**

<b>Title</b>	<b>Authors</b>	<b>Publisher</b>
Introduction to Plant Biotechnology	H.S.Chawla	3 <sup>rd</sup> edition, oxford & Hill
Biotechnology expanding horizons	B.D.Singh	5 <sup>th</sup> edition, 2012, Kalyani publication
Elements of Biotechnology	P.K.Gupta	Rastogi publication 2 <sup>nd</sup> edition
Biotechnology Entrepreneurship	Craig Shimasaki	2 <sup>nd</sup> Edition, Academic Press 2020

**P P Savani University**  
**School of Sciences**  
 Syllabus, Teaching and Examination Scheme

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**Course Name:** Bioinformatics Practical

**Course Code:** SSBT3180

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	4	0	2	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to acquire the fundamental knowledge about molecular database, learn various tools of data analysis, know about the searching and retrieval of sequences and learn sequence alignment

**Course Contents:**

Section-I		
Module	Content	Hours
1	Sequence information resource	10
2.	Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene,	10
3.	Understanding and using: PDB, Swissprot, TREMBL	10
4.	Retrieval of information from nucleotide databases.	10
5.	Sequence alignment using BLAST.	10
6.	Multiple sequence alignment using Clustal W.	10

**Course outcome:**

**CO-1:** Perform and learn about the Sequence information resource such as NCBI, EMBL etc.

**CO-2:** Perform and analyse sequences from various web resources: EMBL, Genbank, Entrez, Unigene,

**CO-3:** Demonstrate the retrieval of information from nucleotide databases

**CO-4:** Examine Sequence alignment using BLAST and Multiple sequence alignment using ClustalX.

**Reference Books:**

Title	Authors	Publisher
Bioinformatics: Principles and Applications.	Ghosh Z. and Bibekanand M.	Oxford University Press. (2008)
Bioinformatics and Functional Genomics. II Edition.	Pevsner J.	Wiley-Blackwell. (2009)

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Syllabus, Teaching and Examination Scheme

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**Course Name:** Project/Training/Report

**Course Code:** SSBT3200

**Prerequisite:** Nil

**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	30	0	15	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

The course is designed to help students learn about the research in state-of-the-art research institutions. This will also provide the students an opportunity to practically use their Biotechnology-based skills in a typical research environment

**Course Contents:**

Content	Months
The students shall carry out 2 months dissertation in an academic or research institution of national/international repute. They must prepare a dissertation/ thesis/Project report on a specific template provided by the School of Sciences. Upon completion of the dissertation, students are required to present their work before the expert committee. Students must submit four copies of their thesis to the department	<b>02</b>

**Course outcome:**

**CO-1:** Develop basic understanding about large scale processes in industry/laboratories, also learn about safe handling of instruments and machines.

**CO-2:** Recognize formatting, drafting reports and results obtained during the period of training

**CO-3:** Demonstrate practical knowledge about instrument working, principle as well as applications

**CO-4:** Learners will equip themselves with skills which can increase their employability

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Syllabus, Teaching and Examination Scheme

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**Course Name:** Seminar  
**Course Code:** SSBT3220  
**Prerequisite:** Nil  
**Teaching and Examination Scheme:**

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
0	6	0	3	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

**Objective(s) of the Course:**

To help students learn about recent topics, trends in the field of subject, research oriented knowledge and presentation skills. This will also provide the students an opportunity to develop good on stage skills

**Course Contents:**

Content	Hours
The students will have to present a topic on recent trends or research going on in the field of Biotechnology or interdisciplinary fields. They must prepare presentation on topic in a specific template provided by the School of Sciences.	<b>90</b>

**Course outcome:**

- CO-1:** Learn to give convincing speeches, present material in a compelling, well-structured and logical order
- CO-2:** Gain deep knowledge of complicated subjects.
- CO-3:** Improve their ability to synthesize, evaluate, and reflect on information
- CO-4:** Learn to respond respectfully to opposing viewpoints