Syllabus Book

B. Sc. Environmental Science

P P Savani University

School of Sciences

Department of

Environmental Science

Effective From: 2022-23

Authored by: P P Savani University

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

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Syllabus, Teaching and Examination Scheme

Course Name: Environmental Studies
Course Code: SSES1070
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

Objectives of the Course:
The course is designed to assist the students to acquire an awareness of the basic fundamentals of the environment like scope,importance, etc.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Multidisciplinary nature of environmental studies** Definition, scope and importance Need for public awareness.	2	10
2	**Natural Resources** Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Casestudies. Land resources: Land as a resource, land degradation, man inducedlandslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitableuse of resources for sustainable lifestyles.	8	30
Section-II			

Module No.	Content	Hours	Weightage (%)
3	**Biodiversity and its conservation** Introduction – Definition: genetic, species and ecosystem diversity. Bio geographical classification of India Value of biodiversity: consumptive use, productive use, social, ethical,aesthetic and option values Biodiversity at global, National and local levels. India as a mega-diversity nation Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlifeconflicts. Endangered and endemic species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	10	35
4	**Social Issues and the Environment** From Unsustainable to Sustainable development; Urban problems related to energy Water conservation, rain water harvesting, watershed management Resettlement and rehabilitation of people; its problems and concerns. Case Studies; Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion,nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act; Forest Conservation Act. Issues involved in enforcement of environmental legislation.Public awareness.	10	25

Course outcomes:

CO-1: To understand the basic knowledge of environment fundamentals.

CO-2: Students will be able to define and distinguish between various natural resources and will learn about human impact on the future sustainability of these resources.

CO-3: Students will learn about the complexity of global biodiversity, major threats, need, and ways for its conservation.

CO-4: Students will get well versed with the acts and laws that deal with the environment like Water Act, Air Act, Environment Protection Act, etc

Reference Books:

Title	Author(s)	Publisher
Environmental Biology	K.C Agrawal	Nidhi Publishers
The Biodiversity of India	Erach Bharucha	Mapin Publishing Pvt Ltd

Course Name: Water & Water Resources
Course Code: SSES1080
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

Objectives of the Course:

This course is designed to understand different types of water resources, properties of water and wastewater, surface and sub-surfacewater and wetlands, and their management.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction** Sources and types of water; hydrological cycle; precipitation, runoff, infiltration, evaporation, evapo-transpiration; Classification of water resources (oceans, rivers, lakes andwetlands). Lentic and lotic water resources	4	15
2	**Properties of water** Physical: temperature, colour, odor, total dissolved solids and total suspended solids; Chemical: major inorganic and organic constituents, dissolved gases, DO, COD, BOD, acidity and alkalinity, electrical conductivity, sodium adsorption ratio; Biological: phytoplankton, phytobenthos, zooplankton, macro-invertebrates and microbes.	8	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Surface and subsurface water** Introduction to surface and ground water; surface and ground water pollution; Water table; vertical distribution of water; Formation and properties of aquifers; Techniques for ground water recharge;	12	35

	River structure and patterns; Watershed and drainage basins; Importance of watershed and watershed management; Rain water harvesting in urban settings.		
4	**Wetlands and their management** Definition of a wetland Types of wetlands (fresh water and marine) Ecological significance of wetlands Threats to wetlands Wetland conservation and management Ramsar Convention, 1971 Major wetlands of India.	6	25

Course outcomes:

CO-1: Students will understand basic concepts of different types of water resources like surface water, ground water, Ice caps and Glaciers, Oceans etc.

CO-2: Students will get well know with the basic Physical (Temperature, Color, Odor etc.), Chemical (COD, BOD, Acidity, Alkalinity etc.) and Biological (Phytoplanktons, Zooplanktons, Phytobenthos etc.) properties of water and wastewater.

CO-3: Students will get information about sources of pollution in groundwater and surface water, Vertical distribution of Ground water, Rainwater harvesting, Watershed management, Methods of artificial recharging of groundwater etc.

CO-4: Students will get information about different types of wetlands, Convention held for preservation of wetlands, Ecological significance and threats to wetlands.

Reference Books:

Title	Authors	Publisher
Water Management in India	Bansil, P.C. 2004	Concept Publishing Company, India
Water Resources Management VII	Water Resources ManagementVII	WIT Press.

Course Name: Environment Studies & Water & Water Resources Practical
Course Code: SSES1090
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

Objectives of the Course:
The course is designed to help students to learn the collection of samples from water, soil, and air and the analysis of water properties by evaluating various Physico-chemical and biological parameters of water and wastewater.

Course Contents:

Sr. No	Content	Hours
1.	Collection of samples- air, water and soil	10
2.	Determination of pH from soil and water samples	10
3.	Estimation of D.O. in water	10
4.	Determination of conductivity from soil samples	10
5.	Case Studies	20

Course outcomes:
CO-1: Students will get the information on the physical characteristics of water such as temperature, solids, odor, and colour.
CO-2: Students will understand the determination of water characteristics by senses of touch, sight, smell and taste. For example, temperature by touch, color, floating debris, turbidity and suspended solids by sight, and taste and odour by smell.
CO-3: Students will be able to collect different kind of samples by using Filtration, Impingement, Grab & Composite sampling methods for analysis purpose.
CO-4: Students can easily analyze the pH, D.O., and conductivity using the respective meters of water, soil, and air samples.

Reference Books:

Title	Author(s)	Publisher
Water Management in India	Bansil, P.C. 2004	Concept Publishing Company, India
Water Resources Management VII	Water Resources Management VII	WIT Press.

Course Name: Inorganic Chemistry

Course Code: SSCH1010

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

Objectives of the Course:

The course is designed to assist the students to study about Classical Mechanics of Atom, periodic properties of elements and detailed learning about chemical bonding and structure of molecules.

Course Contents:

Section-I			
Module	**Content**	**Hours**	**Weightage (%)**
1	**Atomic structure - Classical Mechanics** 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, arrangement of electrons in orbits, Zeeman effect.	08	27
2	**Periodic Properties of Elements** Classification of elements, periodic table, Mendeleev's periodic table, significance and its limitation, Modern periodic table, the long form of periodic table, Electronic configurations of elements and periodic table, s, p, d, f block elements, Detailed discussion of the following properties of the elements, with reference to s and p-block. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) atomic radius, metallic radius, ionic radius, crystal radii, van der Waals, Covalent radii (c) Ionization enthalpy, Successive ionization enthalpies and	12	40

	factors affecting ionization energy. Applications of ionization enthalpy. (d) Electron gain enthalpy, trends of electron gain enthalpy. (e) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's, electro negativity scales, Variation of electro negativity with bond order, partial charge, hybridization, group electro negativity		
Section-II			
3	**Chemical Bonding and Structure of Molecules:** **General terms**: Chemical bond, valence, valence electrons, Bonding and Non-bonding electrons, Lewis symbols, Octet rule. **Ionic bond**: Definition, Condition for formation of ionic bond, Factors governing formation of ionic bond, Characteristics of ionic compounds. **Covalent bond:** 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. **Hydrogen bonding:** Definition, conditions for H-bond formation, examples, Types of H-bonds, Characteristics of H-bonded compounds. **Metallic bond:** Definition, The Electron sea model	10	33

Course outcomes:

CO-1: To describe the theories of atom's discovery with its' spectral emission, Bohr's atomic model, Photoelectric effect.

CO-2: To explain Periodic table, electronic configuration of elements and detailed discussion about propert elements of periodic table.

CO-3: To demonstrate the structural geometry and hybridization of the molecules, Ionic bonding, Covalen Metallic bonding, hydrogen bonding

Reference Books:

Title	Authors	Publisher
Concise Inorganic Chemistry	J.D. Lee	Wiley India
Engineering Chemistry (16th Edition)	P.C. Jain and Monika Jain	Dhanpat Rai publishing company
Essentials of Physical Chemistry	A.Bahl, B.S. Bahl and G.D.Tuli	S. Chand Publishing
Advanced Practical Physical Chemistry	J. B. Yadav	Krishna Prakashan Media
Vogel's Qualitative Inorganic Analysis 7th Edition	G. Svehla, B. Sivasankar	Pearson

Course Name: Physical Chemistry I

Course Code: SSCH1020

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

Objectives of the Course:

The course is designed to assist students to acquire comprehensive knowledge of the liquid state, solutions, and titrations, the concept of pH, properties, synthesis mechanism, applications of Colloids, and solving numerical problems.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Solution** Solute, Solvent, Solution, Methods of expressing concentration terms for solution, Examples of solution preparation, Titration, Types of titrations, Measuring the endpoint of a titration via different methods, Difference between endpoint and equivalence point, Theory of acid–base indicators; selection of indicators and their limitations.	6	20
2	**Liquid state** Types of intermolecular forces with suitable examples (Dipole-Dipole, London forces, H-bonding), Definition, unit, effect of temperature and characterization for following physical properties: 1) Vapor pressure, 2) Surface tension, 3) Viscosity, 4) Refractive index, 5) Optical Activity.	8	27
Section-II			
3	**Colloids** Introduction, Classification of colloids, Preparation of colloidal solutions via condensation and dispersion methods, Dialysis, Ultra-filtration, Properties of colloidal solutions, Coagulation or flocculation of colloids, Stability of colloids by different methods, Gold number, Zeta potential, Application of colloids.	8	27

4	**Acids and Bases** Basic properties of acids and bases, Acid-base concepts, Derive equation for relative strength of strong acids and bases, Calculate the relative strength of weak acids and bases, pH, pH scale, measurements of pH by pH paper, indicators and pH meter, 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 human body. Numerical Problems.	8	26

Course outcomes:

CO-1: Facilitate the learner to make solutions of various molar concentrations and familiarize students with the principles of analytical chemistry and basic analytical techniques including volumetric analysis.

CO-2: Learners will understand the types of bonding present in liquid state and will be able to recognize the physical properties of liquids.

CO-3: Students should be able to describe the types of colloids, their stability, preparation and identify their applications.

CO-4: Students will be able to recognize acids and bases, will understand the importance of pH and enumerate sums based on them.

Reference Books:

Title	Authors	Publisher
Concise Inorganic Chemistry	J.D. Lee	Wiley India
Engineering Chemistry (16^{th} Edition)	P.C. Jain and Monika Jain	Dhanpat Rai publishing company
Essentials of Physical Chemistry	A.Bahl, B.S. Bahl and G.D. Tuli	S. Chand Publishing
Advanced Practical Physical Chemistry	J. B. Yadav	Krishna Prakashan Media
Vogel's Qualitative Inorganic Analysis 7^{th}Edition	G. Svehla, B. Sivasankar	Pearson

Course Name: Chemistry Practical

Course Code: SSCH1030

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

Objectives of the Course:

The course is designed to understand the role of estimation in chemistry, solution preparation, analysis of properties of liquids handling of basic equipment in the laboratory.

Course contents:

Module No.	Name of the practical	**Hours**
1.	Introduction to laboratory, safety rules during practical, knowledge about different sign and symbols regarding hazardous materials, calibration and use of apparatus/common glassware and their uses. Volumetric titrations, quantitative analysis, quantitative analysis, precautionsduring experiments and titrations.	**6**
2.	Prepare given concentration solutions and standardized them.	**6**
3.	Estimation of free alkali present in different soaps/detergents	**6**
4.	Estimation of oxalic acid and sodium oxalate in a given mixture.	**6**
5.	Estimation of ferrous ions using potassium dichromate by internal indicatormethod	**6**
6.	Prepare 0.1N NaOH solution.	**6**
7.	Surface tension measurements of different solvents by stalagmometer	**6**
8.	Viscosity of different solvents by Ostwald's viscometer.	**6**
9.	pH metric titration of (i) strong acid vs. strong base	**6**
10.	Determine the precipitation values for arsenious sulphide sol.	**6**

Course outcomes:

CO-1: Student will understand how to use different glassware, instruments and chemicals, what are precautions to be taken while using them, and how to calibrate different equipment.

CO-2: Students can prepare different concentration solution and standardize them too.

CO-3: Learner can estimate different entities like free alkali in soap, oxalates, ferrous ion etc in given compounds.

CO-4: Students can measure some properties like surface tension, viscosity, pH, colloidal property, etc., and their effect on daily used fluids.

Reference Books:

Title	Authors	Publisher
Advanced Practical Physical Chemistry	J. B. Yadav	Krishna Prakashan Media
Vogel's Qualitative Inorganic Analysis 7^{th}Edition	G. Svehla, B. Sivasankar	Pearson

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

Objectives of the Course:

The course is designed to help students to gain information about various types of microorganisms and their general characteristics. To make them understand the diversity, morphology, structure, life cycle, and useful and harmful activities ofalgae 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	12	25
2	**Bacterial Diversity:** General characteristics of Bacteria, archaea, cyanobacteria. Classification and economic importance	11	25
	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	11	25
4	**Algal Diversity:** General characteristics of algae including occurrence, thallus organization, algae cell ultra-structure Classification and Economic importance of algae	11	25

Course outcomes:

CO-1: Students will learn about the various field in microbiology and the future scope of microbiology

CO-2: Students will gain knowledge about the different types of microorganisms and their significance.

CO-3: Students will gain knowledge about the morphology structure, characteristics of Algae, and their significance

CO-4: Students will gain knowledge about the morphology structure, characteristics of Fungi, and their significance

Reference Books:

Title	Authors	Publisher
Microbiology	Prescott	McGraw-Hill
Microbiology	Peleczar	Tata McGraw-Hill
General Microbiology	StanierRY, Ingraham JL, WheelisML, and Painter PR	5th 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

Objectives of the Course:

The course is designed to familiarize students with microbial classification and nomenclature systems for microbes, and theidentification of microorganisms by using suitable

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 systematic	15	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.	11	25
Section-II			
3	**Bacterial cell surface appendages:** Pili, Fimbrae, Cell inclusions, Gas Vesicles, Endospores, Nucleoid, Chemotaxis Structures responsible for motility in bacteria;Types of motility	11	25
4	**Concept of Microscopy-resolution:** Simple and compound microscopy Various types of microscopy	08	20

Course outcomes:

CO-1: Students will be able to know the basis of the classification of various microorganisms in the earlier and current eras. Students will be able to name or classify bacteria by taxonomic study, etc

CO-2: Students shall be able to differentiate microbes based on their morphology and categorize them as prokaryotes or eukaryotes

CO-3: Students will be able to know the major differences between prokaryotic and eukaryotic microbes based on their internal structure. Moreover, students will also be able to differentiate/recognize microbes based on their internal structures.

CO-4: Students will acquire specialization in microscopic techniques for the identification of microbes. Moreover, students could classify and differentiate microbes on the basis of electron and phase-contrast microscopy. Students will be able to handle electron microscopes etc and could become technical specialists.

Reference Books:

Title	**Authors**	**Publisher**
Microbiology	Prescott	McGraw-Hill
Microbiology	Peleczar	Tata McGraw-Hill
General Microbiology	StanierRY, Ingraham JL, Wheelis ML, and Painter PR	McMillan
Experiments in Microbiology, Plant Pathology andBiotechnology	Aneja	New Age Publisher
Microbiology Introduction	Tortora Gerad	Benjamin Cumming

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

Objectives of the Course:
This course is designed to enable students to handle basic instruments in the microbiology laboratory. The students will learnto prepare microbial culture mediums for different types of microbes.

Course Contents:

Section-I		
Module No.	**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, lightmicroscope, 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 agarplates to air	6
8	Microscopic observation of morphological characteristics of Protozoa/Yeast using compoundmicroscope	6
9	Study of bacterial motility by hanging drop techniques	6
10	Preparation of culture media for microbes (bacteria, fungal, algal cultivation)	6

Course outcomes:
CO-1: Students can prepare solid,and broth agar media for growing microbes
CO-2: Students could isolate microbes independently from environmental, clinical and food, and industrial samples.
CO-3: Students could independently handle and operate various microbiological laboratory instruments and also could train for the future as technical professionals.

CO-4: Students could perform streaking, spreading, and serial dilutionwhich is considered the backbone of microbiology practicals with perfection which could they apply in hospitals, industries, and water samples.

Reference Books:

Title	Authors	Publisher
Microbiology	Prescott	McGraw-Hill
Microbiology	Peleczar	Tata McGraw-Hill
General Microbiology	StanierRY, Ingraham JL, Wheelis ML, and Painter PR	McMillan
Experiments in Microbiology, Plant Pathology andBiotechnology	Aneja	New Age Publisher
Microbiology Introduction	Tortora Gerad	Benjamin Cumming

Course Name: Physics I

Course Code: SSCH1040

Prerequisite: Nil

Teaching and Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	2	0	3	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

Objectives of the Course:

This course is designed to enable students to acquire an understanding of basic physics concepts like properties of matter,electro-statistics, and non-linear optics.

Course Contents:

	Section-I		
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**General Physics** Definition, unit, resolution of forces, Newton's law of motion, types of motion, force of gravity and center of gravity, reaction forces, equilibrium, determination of equilibrium of body, work, power, energy, torque. Force of friction, laws of static and dynamic friction, limits of friction,friction a necessity and evil.	07	20
2	**Laser & fiber optics** Introduction, Characteristics of laser radiation, Spontaneous and stimulated mission,Working of LASER with basic idea about Population Inversion, Pumping mechanism, Optical Resonators, Nd:YAG LASER , Applications of LASER. Introduction of Optical Fiber Advantages of Optical Fiber, Total Internal Reflection, Numerical Aperture and Acceptance angle, Modes of Propagation, Types of Optical Fiber, Applications of optical fiber.	08	25
Section-II			

3	**Properties of matter** Stress and strain, Hooke's law, factors affecting elasticity, three types of elasticity, equivalence of a shear to a compression and an extension at right angles to each other, shearing stress equivalence to an equal linear tensile stress and an equal linear compressive stress straight angles to each other, deformation of a cube-bulk modulus, modulus of rigidity, Young's modulus, relation connecting elastic constants, Poisson's ratio. Torsional pendulum, determination of the coefficient of rigidity η.	07	25
4	**Electrostatics** The electric field, electric field lines, the electric field due to a point charge, Gauss' law and Coulomb's law, Electric current, current density, resistance and resistivity, Ohm's law, RC circuits. Introduction to Semiconductors, intrinsic and extrinsic Semiconductors, Types of Diodes, Advantages of Semiconductor devices, Transistors, Types of transistor, Bipolar Junction Transistor, junction field effect transistor	08	30%

Course outcomes:

CO-1: Students will be able to demonstrate their knowledge of the basic scientific principles and fundamental concepts and skills of the field.

CO-2: Students will be able to describe the different types of lasers, its principle, properties of laser beams and classify the different types of optical fiber.

CO-3: Learners will be able to study the elastic behavior and bending behavior of beams and analyze the expression of young's modulus.

CO-4: Apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances.

Reference Books:

Title	Authors	Publisher
Engineering Physics	B.K. Pandey & S. Chaturvedi	Cengage Learning
Electronic Principles	Malvino, A.P	Tata Mc Graw Hill
Fundamentals of Physics	Halliday, Resnick and Walker	Wiley
Principal of Electronics	Mehta and Mehta	S. Chand

Course Name: Physics Practical-I
Course Code: SSCH1040
Prerequisite: Nil

Teaching and Examination Scheme:

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

CE: Continuous Evaluation, ESE: End Semester Examination

Objective(s) of the Course:

The aim of course is to apply and illustrate the concepts of electricity and magnetism through experiments, the concepts of optics through experiments, the concepts of properties of matter through experiments, the principles of electronics through experiments.

Course Contents:

Module	Name of Practical/Tutorial	Hours
1.	Error analysis	2
2.	Planck's constant	4
3.	Numerical aperture and Acceptance angle of an optical fiber	2
4.	Hall effect	4
5.	Hysteresis loop	2
6.	Young's Modulus	4
7.	LED I-V Characteristic	4
8.	Capacitor and Resister in series and parallel.	4
9.	RLC Circuit	4

Course outcome:

CO-1: To carry out experiments to understand the laws and concepts of Physics.
CO-2: To learn about Laser and Fiber optics
CO-3: To learn about properties of matter.

Reference Books:

Title	Authors	Publisher
Engineering Physics	B.K.Pandey & S. Chaturvedi	CENGAGE Learning
Electronic Principles	Malvino, A.P.	Tata McGraw Hill, 1999.
Fundamentals of Physics	Halliday, Resnick and Walker	Wiley
Principal of Electronics	Mehta and Mehta	S. Chand
Elementary Linear Algebra (Application Version)	Anton and Rorres	Wiley India Edition

Course Name: Mathematics I (Group A)
Course Code: SSCH1050
Prerequisite: Nil

Teaching and Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	1	3	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

Objectives of the Course:
The course is designed to evaluate limits using different methods and standard limits and define the continuity of afunction in an interval. To utilize the rules of exponential and logarithmic functions

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Function:** Domain, Range, One-one, onto function, composition of functions, Complex number: Algebra of complex number. Quadratic equation andits solution.	06	20
2	**Exponential & Logarithmic function:** Elementary properties. Trigonometric functions: sine, cosine, tan, cot, cosec, sec and their inverse function. Formulae: cos(A±B), sin(A±B), tan(A±B), sin(2θ), cos(2θ), tan(2θ).	08	26
Section-II			
3	**Determinant:** 2×2, 3×3 order, Expansion, elementary properties, Matrices: 2×2,3×3 order, Algebra of matrices (Addition, Scalar product, product of two matrices)	08	27
4	**Vector algebra:** Vector space R^2 and R^3 Operation: Addition, scalar multiplication and vector multiplication, magnitude of vector, Inner product, Box/Triple product,angle betweentwo vectors.	08	27

Course outcomes:

CO-1: To learn to prepare media for bacteria, fungi, and algae

CO-2: To learn to isolate microbes from air, water, and soil

CO-3: To learn to have prior information about the basic instruments which are routinely used in a microbiology laboratory

CO-4: To learn techniques relevant to microbiology

Reference Books:

Title	Authors	Publisher
A First Course in Mathematical Analysis	D Somasundaram and BChoudhary	Narosa Publishing House
Functions of a Complex Variable	J. N. Sharma	Krishna Prakashan
Plane trigonometry, Part I and II	S.L.Loney	McMillan & Co. London.
Text book of Matrices	Shantinarayan	S.Chand and Co.
Elementary Linear Algebra (ApplicationVersion)	Anton and Rorres	Wiley India Edition

Course Name:	Mathematics Tutorial-I
Course Code:	SSCH1050
Prerequisite:	Nil

Teaching and Examination Scheme:

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

CE: Continuous Evaluation, ESE: End Semester Examination

Objective(s) of the Course:

The course is designed to assist the students to analyze functions and their graphs as informed by limits and derivatives, to outline the exponential & logarithm properties and determine a quadratic function's minimum or maximum value, to use determinants and their interpretation as volumes, describe properties of the determinant, to understand the basic ideas of vector algebra: linear dependence and independence

Course Contents:

Module	Name of Practical/Tutorial	Hours
1.	Function 1	3
2.	Complex Number and Quadratic Equations	3
3.	Exponential and Logarithmic Functions	3
4.	Trigonometric functions 1	3
5.	Trigonometric functions 2	3
6.	Determinant 1	3
7.	Determinant 2	3
8.	Matrices	3
9.	Algebra of Vector spaces R2 and R3	3
10.	Inner Product	3

Course outcome:

CO-1: To evaluate limits using different methods and standard limits and define continuity of a function in an interval.

CO-2: To utilize the rules of Exponential & logarithmic functions

CO-3: To provide requisite information about Determinants

CO-4: To impart insights of Vector Algebra

Reference Books:

Title	Authors	Publisher
A First Course in Mathematical Analysis	D Somasundaram and B Choudhary	Narosa Publishing House
Functions of a Complex Variable	J. N. Sharma	Krishna Prakashan
Plane trigonometry, Part I and II	S.L.Loney	McMillan & Co. London.
Text book of Matrices	Shantinarayan	S.Chand and Co.
Elementary Linear Algebra (Application Version)	Anton and Rorres	Wiley India Edition

Sem-2

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Ecology and Ecosystems- I
Course Code: SSES1100
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

Objectives of the Course:
The course is designed to make the students aware of the real-life interaction of components of the ecosystem. Studentswill learn about the various factors involved in the development of the ecosystem.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction** Sources and types of water; Hydrological cycle; precipitation, runoff, infiltration, evaporation,evapo-transpiration; Classification of water resources (oceans, rivers, lakes and wetlands).	4	15
2	**Ecology of individuals** Ecological amplitude; Liebig's Law of the Minimum; Shelford's Lawof Tolerance; phenotypic plasticity; Ecotypes; ecoclines; acclimation; ecological niche; types of niche: Eltonian niche, Hutchinsonian niche, fundamental niche, realized niche; niche breadth; niche partitioning; niche differentiation; thermoregulation; Strategies of adaptation in plants and animals.	10	20
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Ecology of populations** Concept of population and meta-population; r- and K-selection Characteristics of population: density, dispersion, natality, mortality,life tables, survivorship curves, age structure Population growth: geometric, exponential, logistic, density-dependent; limits to population growth.	6	30

4	**Ecology of communities** Discrete versus continuum community view Community structure and organization: physiognomy, sociability, species associations, periodicity, biomass, stability, keystone species, ecotone and edge effect; species interactions: mutualism, symbiotic relationships, commensalism, amensalism, proto-cooperation, predation, competition, parasitism, mimicry, herbivory Ecological succession: primary and secondary successions, models and types of successions, climax community concepts, examples of succession.	9	35

Course outcomes:

CO-1: The students will be able to describe the properties of water and different types of water sources.
CO-2: The learners will get to know the core concepts and methods of ecological science and their application in environmental problem-solving.
CO-3: The learners will be able to express knowledge of the relationships between plants, animals, and humans' influence on the surrounding environment.
CO-4: Students will be able to analyze the impact of predation, competition, and interdependence among living things.

Reference Books:

Title	Authors	Publisher
Fundamentals of Ecology	Odum, E.P. 1971	W.B. Sounders.
Ecology, Environment and ResourceConservation	Singh, J.S., Singh, S.P. & Gupta, S.R. 2006	Anamaya Publications.
The Ecology of Plants	Gurevitch, J., Scheiner, S. M., & Fox, G. A. 2002	Sinauer associates incorporated.

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Physical Environment
Course Code: SSES1110
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

Objectives of the Course:

The course is designed to help the students to learn various factors involved in the development of the ecosystem and basic physics involved in the solar system.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction to Environment** Concept and types of environment: Physical, Biological and Cultural -Environment as perceived by different sciences. Earth & the Solar System - Movements of the earth, Kepler's laws of motion, Newton' law of gravitation, moment of inertia, Coriolis force. Earth's magnetic field- Magnetic field intensity, magnetic lines of force, magnetic induction. magnetic field around a current carrying conductor, Biot-savart's law, Tangent Galvanometer. Solar energy and heat balance, Controls over heating and cooling-land and water differences, Heating processes-radiation, green-house effect, conduction, compression, condensation, Cooling processes- evaporation, expansion, advection, temperature inversions.	15	40
2	**Atmosphere** Composition of the atmosphere, Air-composition, density, thermalstructure and stratification Factors affecting global distribution of insolation, Causes and effects of: insolation; pressure & winds; monsoon system;humidity phenomena; air masses; precipitation; types of clouds	10	35

Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Marine & Submarine Environment** Coastal Zone Classification Characteristic physical features of coastal areas Ocean floor deposits and coral reefs Ocean water- temperature, salinity, circulation.	5	25

Course outcomes:

CO-1: Students will get to know about the various types of environments.

CO-2: Students will have a fundamental understanding of the atmosphere and the dynamic and physical processes that control weather and climate.

CO-3: The students will be able to describe the movement of the Sun, Moon, and Earth in the Solar System.

Co-4: The students will have a good understanding of the effect of solar energy on the Earth's climate.

Reference Books:

Title	Authors	Publisher
Physical Geography	Savindra Singh.S	Prayag Pustak Bhavan, Allahbad
Geology, Environment And Society	Valdiya K.S	University press

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Ecology and Physical Environment Practical
Course Code: SSES1120
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

Objectives of the Course:
To help learners to learn the various factors involved in the development of the ecosystem.

Course Contents:

Sr. no.	Content	Hours
1.	Kepler's law of planetary motion	10
2.	Newton's law of gravitation	10
3.	Population ecology	10
4.	Characteristics of population	10
5.	Species richness	10
6.	Solar energy budget	10

Course outcomes:

CO-1: The students will have in-depth knowledge of Climatic, Physiographic, and Biotic factors that involve the ecosystem.

CO-2: Students will understand different kind of laws including Kepler's law of planetary motion and Newton's law of Gravitation.

CO-3: Students can calculate the amount of Solar radiation come to the earth every day.

CO-4: Students will understand different kinds of laws including Kepler's law of planetary motion and Newton's law of Gravitation.

Reference Books:

Title	Authors	Publisher
Fundamentals of Ecology	Odum, E.P.	W.B. Sounders.
Ecology, Environment and ResourceConservation	Singh, J.S., Singh, S.P. & Gupta, S.R.	Anamaya Publications
The Ecology of Plants	Gurevitch, J., Scheiner, S. M., &Fox, G. A.	Sinauer associates

Course Name: Organic Chemistry

Course Code: SSCH1060

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

Objectives of the Course:

- The present study supports undergraduates to acquire the knowledge about the fundamental of organic chemistry
- An understanding of physical chemistry is an important area for students to complete a major or minor study inchemistry, and it lies on the borderline with engineering

Course Contents:

Section-I			
Module	**Content**	**Hours**	**Weightage (%)**
1	**Aliphatic hydrocarbons** Definitions (Bond distances, Bond angles, Torsion angle, Isomers) Alkanes: nomenclature, sources, methods of formation, Physical properties and chemical reactions. Alkenes: Nomenclature, method of preparation, Physical properties, Reactions of alkenes. Dienes: nomenclature, classification of dienes methods of formation of Butadiene chemical reactions 1, 2 and 1, 4 additions, polymerization, Diels-Alder Reaction. Alkynes: nomenclature, Isomerism, methods of formation, Physical properties, chemical reactions, electrophilic and nucleophilic addition reactions of acetylene.	8	27
2	**Aromatic hydrocarbons** Introduction, Nomenclature of aromatic compounds, Source of aromatic compound, Arenes, Monocyclic Arens, Aromaticity, Modern Theory of Aromaticity, Hückel's rule, Nomenclature, Method of preparation of benzene, Physical properties, Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism, Aromatic addition reactions, Applications of benzene	8	27

Section-II			
3	**Fundamentals of Organic Chemistry** Introduction, Homolytic and Heterolytic fission with suitable examples, Electronic Displacements, Inductive, Electromeric, Resonance and mesomeric effects, hyperconjugation and their applications, Dipole moment, types of arrow, Electrophiles and Nucleophiles, Leaving groups, Basic idea about Carbocations, Carbanions, Free radicals and Carbenes and their stability, Types of organic reactions and their mechanism: Substitution reactions Elimination and, Addition, Rearrangement reactions, Beckmann rearrangement, Aldol condensation.	6	20
4	**Basic of Stereochemistry** History and introductions of stereochemistry Molecular Projections: Fischer Projections, Characteristics and Limitations, Sawhorse Projections, Newman Projections, Inter conversions of Fischer-Sawhorse-Newman Projections. Geometrical Isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration, Comparison between D, L and R, S Nomenclature**.**	8	26

Course outcomes:

CO-1: At the end of this course students will be able to distinguish aliphatic and aromatic hydrocarbons.

CO-2: Students will be able to name different organic compounds as per the IUPAC nomenclature.

CO-3: Learners will be able to understand the variable properties in Organic compounds as a function of the present functional group.

CO-4: Students will be able to explain the main physical and chemical properties of aromatic and aliphatic hydrocarbon compounds. They will be able to distinguish between aromatic and aliphatic systems.

Reference Books:

Title	Authors	Publisher
Advanced organic chemistry	Arun Bahl and B S Bahl	S. Chand
Stereochemistry	Ranjit S. Dhillon, Inder Pal Singh, Chinnappan Baskar	Narosa Publishing House
Essentials of Physical Chemistry	A. Bahl, B. S. Bahl and G. D. Tuli	S. Chand Publishing
Atkins' Physical Chemistry 10th Edition	Peter Atkins and Julio de Paula	Oxford University Press
Organic Chemistry 7th Edition	Robert Neilson Boyd, SaibalKanti Robert, ThorntonMorrison	Pearson
Advanced Practical Physical Chemistry	J. B. Yadav	Krishna Prakashan Media
Comprehensive Practical Organic Chemistry: Qualitative Analysis	V.K. Ahluwalia, S. Dhingra	Universities Press

Course Name: Physical Chemistry – II

Course Code: SSCH1070

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

Objectives of the Course:

The present study supports undergraduates to acquire the knowledge about the fundamental of organic chemistry. An understanding of physical chemistry is an important area for students to complete a major or minor study in chemistry, and it lies on the borderline with engineering

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Solutions and Colligative Properties** Dilute solutions; lowering of vapour pressure, Raoult's law, Real solution, elevation of boiling point, freezing point depression, Osmotic pressure, Isotonic solutions, Reverse Osmosis, colligative properties of electrolytes, Relation between van'thoff factor and degree of dissociation, Henry'sLaws and theirapplications.	6	20
2	**Thermodynamics** 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, Isothermal reversible expansion and reversible expansion work of an ideal gas, Internal energy, Sign conversations and units, First law of thermodynamics, enthalpy of system, Relation between H and E, Heat capacity, Specific and molar heat capacities, Concept of entropy, Entropy, Statement of the second law of thermodynamics, Statement of the third law, Units of entropy, Zeroth law of thermodynamics.	8	27
Section-II			

3	**Chemical Kinetics** 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, Psuedo 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, Collision theory of reaction rates, Discuss postulates of the collision theory, Effect of temperature on reaction rate, Limitations of the collision theory.	8	27
4	**Adsorption** Introduction, Types of adsorption, Adsorption of gases by solids, Comparison of physical adsorption and chemisorption, Adsorption isotherms, Freundlich adsorption isotherms and its limitations, Langmuir adsorption isotherms at high & low pressure and its limitations, Applications of adsorption, Ion– exchange adsorption, Applications of ion–exchange adsorption.	8	26

Course outcomes:

CO-1: Students will learn to extend their knowledge about the solutions and estimate colligative properties.
CO-2: Students will be able to recognize the basic concepts of thermodynamics.
CO-3: Learners will be able to classify reactions based on their order, and molecularity and relate the concepts.
CO-4: Students will be able to describe the phenomenon of adsorption and replicate it in a laboratory experiment.

Reference Books:

Title	Authors	Publisher
Advanced organic chemistry	Arun Bahl and B S Bahl	S. Chand
Stereochemistry	Ranjit S. Dhillon, Inder PalSingh, Chinnappan Baskar	Narosa Publishing House
Essentials of Physical Chemistry	A. Bahl, B. S. Bahl and G. D.Tuli	S. Chand Publishing
Atkins' Physical Chemistry 10^{th} Edition	Peter Atkins and Julio de Paula	Oxford University Press
Organic Chemistry 7^{th} Edition	Robert Neilson Boyd,Saibal Kanti Robert, Thornton Morrison	Pearson
Advanced Practical Physical Chemistry	J. B. Yadav	Krishna Prakashan Media
Comprehensive Practical Organic Chemistry:Qualitative Analysis	V.K. Ahluwalia, S. Dhingra	Universities Press

Course Name: Organic and Physical Chemistry Practical

Course Code: SSCH1080

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

Objectives of the Course:

- The present study supports undergraduates to acquire the knowledge about the fundamental of organic chemistry.
- An understanding of physical chemistry is an important area for students to complete a major or minor study in chemistry, and it lies on the borderline with engineering

Course Contents:

Section-I		
Module No.	**Content**	**Hours**
1	Introduction to laboratory, Safety rules during practical, Calibration and use of apparatus/common glassware and their uses. precautions during experiment and titrations.	**6**
2	Purification of organic compounds by crystallization (solvents: Water, Alcohol, Alcohol-Water)	**6**
3	Determine melting point, boiling point, and solubility of various organic compounds.	**6**
4	Identify hydrocarbons (aliphatic and aromatic) by chemical tests.	**6**
5	Qualitative Analysis of Organic Compounds (Single component).	**6**
6	To determine the specific optical rotation of glucose by polarimeter	**6**
7	To determine the molar mass of an unknown solid using freezing point depression.	**6**
8	Determination of cloud point of a surfactant in the presence of salts.	**6**
9	To study the monomolecular reaction in the hydrolysis of methyl acetate in 0.5 NHCl at different initial concentrations.	**6**
10	To study the adsorption of given organic acid by animal charcoal.	**6**

Course outcomes:

CO-1: Students will understand how to use different glassware, instruments, and chemicals, what are precautions to be taken while using them, and how to calibrate different equipment.

CO-2: Students can measure melting point, boiling point, viscosity, solubility, freezing point depression, and crystallization of the compounds.

CO-3: Students have knowledge about the specific rotation of organic compounds and can measure the cloud point of surfactant in the presence of different conditions.

CO-4: Students can measure different absorption levels with the use of a spectrophotometer and measure the adsorption of coal. They also have an idea about chemical kinetics, rate of reaction, and equilibrium

constant.

Reference Books:

Title	Authors	Publisher
Advanced organic chemistry	Arun Bahl and B S Bahl	S. Chand
Stereochemistry	Ranjit S. Dhillon, Inder Pal Singh, Chinnappan Baskar	Narosa Publishing House
Essentials of Physical Chemistry	A. Bahl, B. S. Bahl and G. D.Tuli	S. Chand Publishing
Atkins' Physical Chemistry 10th Edition	Peter Atkins and Julio dePaula	Oxford University Press
Organic Chemistry 7th Edition	Robert Neilson Boyd,Saibal Kanti Robert, Thornton Morrison	Pearson
Advanced Practical Physical Chemistry	J. B. Yadav	Krishna Prakashan Media
Comprehensive Practical Organic Chemistry: Qualitative Analysis	V.K. Ahluwalia, S. Dhingra	Universities Press

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

Objectives of the Course:

- To learn about cell and its organelles.
- To develop basic understanding for cellular structures and there functions.
- To make students understand process about cell division and cancer.

Course Contents:

Module No.	Content	Hours	Weightage (%)
	Section-I		
1	**Cells:** Discovery of cells, Basic properties of cells, Fundamental classes of cells: Prokaryotic (Bacterial cell, Archaeal cell), Eukaryotic cells (Plant and Animal), Viruses	10	20
2	**Structure and various models of biological membranes:** Organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport.	12	25
	Section-II		
3	**Structure, composition and functions of:** Membrane Vacuolar system, and cytoskeleton Endoplasmic reticulum Golgi complex	13	30
4	**Structure, composition and functions of:** Lysosomes Ribosomes Mitochondria Chloroplasts Nucleus	10	25

Course outcomes:

CO-1: The students will learn about the origin of cell, cell theory and the difference between prokaryotic and eukaryotic cells.

CO-2: Each cell organelle has a different functioning and structure. The students will learn about it in detail.

CO-3: The students will have in-depth knowledge about the fluid mosaic model, cell recognition, membrane transport and the various functioning of cell membranes in general.
Co-4: The students will learn the structure and functioning of the cell organelles.

Reference Books:

Title	Authors	Publisher
Cell and Molecular Biology: Concepts andExperiments.	Karp, G. 2010.	6th Edition. John Wiley & Sons. Inc.
Cell and Molecular Biology.	De Robertis, E.D.P. and De Robertis, E.M.F. 2006.	8thedition. LippincottWilliams and Wilkins,Philadelphia
Cell Biology	Bhatia KN	Trueman
The Cell: A Molecular Approach	Geoffrey M. Cooper, E. Hausman	Sinauer

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

Objectives of the Course:

- To learn about cell and its organelles
- To develop basic understanding for cellular structures and there functions.
- To make students understand process about cell division and cancer.

Course Contents:

Section-I			
Module	**Content**	**Hours**	**Weightage (%)**
1	The Cell cycle and its Regulation via various Checkpoints	10	25
2	Mitosis: cell division of somatic cell, Various Phases (Prophase, Prometaphase, Metaphase, Anaphase, Telophase), Forces required for Mitotic Movements, Cytokinesis	12	25
Section-II			
3	**Meiosis:** cell division of gametic cell, Various Phases in Meiosis I and Meiosis II, Genetic recombination during Meiosis	13	25
4	**Oncology:** study of Cancer, types and molecular basis of cancer, Programmed cell death(PCD)	10	25

Course outcomes:

CO-1: Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.

CO-2: Students will understand how these cellular components are used to generate and utilize energy in cells.

CO-3: Students will understand the cellular components underlying mitotic and meiotic cell, division.

CO-4: Students will apply their knowledge of cell biology to selected examples of changes in cell function. These can include responses to environmental or physiological changes or alterations of cell function brought about by mutation.

Reference Books:

Title	Authors	Publisher
Cell and Molecular Biology: Concepts andExperiments.	Karp, G. 2010.	6thEdition. John Wiley & Sons.Inc.
Cell and Molecular Biology.	De Robertis, E.D.P. and DeRobertis, E.M.F. 2006.	8thedition. Lippincott Williams and Wilkins,Philadelphia
Cell Biology	Bhatia KN	Trueman
The Cell: A Molecular Approach	Geoffrey M. Cooper, Robert E. Hausman	Sinauer

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

Objectives of the course :

- To learn about cell and its organelles. To develop basic understanding for cellular structures and there functions.
- To make students understand process about cell division and cancer.

Course Contents:

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

Course outcomes:

CO-1: The student will understand the different types of cell organelles present in plant and animal cells. They will also able to differentiate prokaryotic and eukaryotic cells.

CO-2: The student will be able to understand basic processes like diffusion, osmosis, dialysis, and plasmolysis.

CO-3: The student will be able to compare different cellular events that happen during cell division.

Co-4: The student will be able to learn the estimation of reducing sugar, protein, and amino acids.

Reference Books:

Title	Authors	Publisher

Cell and Molecular Biology: Concepts andExperiments.	Karp, G.	6thEdition. John Wiley & Sons.Inc.
Cell and Molecular Biology.	De Robertis, E.D.P. and DeRobertis, E.M.F.	8thedition. Lippincott Williams and Wilkins,Philadelphia
Cell Biology	Bhatia KN	Trueman
The Cell: A Molecular Approach	Geoffrey M. Cooper, Robert E.Hausman	Sinauer

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Physics II

Course Code: SSCH1090

Prerequisite: Physics-I

Teaching and Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	2	0	3	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

Objectives of the Course:

The aim is to provide comprehensive knowledge and understanding in the various fields and enable students to pursuethe subject at a cutting-edge level future

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Magnetic Materials:** Magnetic moment, Magnetic dipole, Magnetic Field strength, Magnetic flux density, Intensity of magnetization, Magnetic dipole moment, Magnetic Field intensity, Magnetic permeability, magnetic susceptibility, Bohr magnetron, Classification of Magnetic Materials on the basis of magnetic moment, Soft and Hard Magnetic Materials, Anti ferromagnetic materials, Ferrites	07	20%
2	**Acoustic and ultrasonic:** Introduction, Classification and Characteristics of sound Sabine's formula for reverberation (Without Derivations) Introduction of Absorption co-efficient Sound absorbing materials Factors affecting the acoustics of building and their remedies Sound Insulation. Properties of ultrasound Generation of ultrasound by (1) piezoelectric method and (2) Magnetostriction method Methods for Ultrasound Velocity measurement Applications of ultrasound	08	25%
Section-II			
3	**Crystal Structure Solids:** Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Types of Bonds. Ionic Bond. Covalent Bond. Van der Waals Bond. Diffraction of x-rays by Crystals. Bragg's Law.	07	25%

4	**Electromagnetic Induction:** Definition Faradays Laws, Fleming's right hand rule, Lenz's Law, Statically and dynamically induced emf. Self-inductance, mutual inductance and coefficient of coupling. Energy stored in magnetic field. Force on current carrying conductor placed in a magnetic field, Fleming's left hand rule**.**	08	30%

Course outcomes:

CO-1: Learners will be able to apply knowledge of magnetism to explain natural physical processes and related technological advances.

CO-2: The students will be able to explain basic methods and topics that are relevant in practical applications of acoustics and ultrasound.

CO-3: Learners will be able to formulate and understand theories explaining the behavior of solid-state physics.

CO-4: Students will be able to demonstrate and interpret the concepts electromagnetic induction.

Reference Books:

Title	Authors	Publisher
Engineering Physics	V Rajendran	Tata McGraw Hill Education
Engineering Physics	Khan B. H	Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Physics Practical-II

Course Code: SSCH1090

Prerequisite: Physics Practical-I

Teaching and Examination Scheme:

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

CE: Continuous Evaluation, ESE: End Semester Examination

Objective(s) of the Course:

The aim of the course is to apply knowledge of magnetism to explain natural physical processes and related technological advances, basic methods and topics that are relevant in practical applications of acoustics and ultrasound, formulate and understand theories explaining the behavior of the solid-state physics, demonstrate and interpret the concepts electromagnetic induction.

Course Contents:

Module	Name of Practical/Tutorial	Hours
1.	To study the Hysteresis loss.	**4**
2.	Determination of the velocity of ultrasonic waves in liquid by ultrasonic interferometer.	**4**
3.	Study of CRO & Measurement of Voltage Amplitude & Frequency	**4**
4.	Basic understanding of step up and down transformer.	**4**
5.	To use a Multimeter for measuring (a) Resistances, (b) A/C and DC Voltages, (c) AC and DC Currents, (d) Capacitances, and (e) Frequencies.	**4**
6.	Understanding the basic logic gates AND, OR, NOT.	**4**
7.	Faraday's Law	**4**
8.	Introduction to virtual lab (Amrita Vishwa Vidyapeetham Virtual Lab)	**2**

Course outcome:
CO-1: To provide an adequate exposure about the behavior of Magnetic materials and magnetism
CO-2: To impart basics of the acoustic of building and ultrasonic waves.
CO-3: To give basic understanding of Solid-state physics and the physical properties of solids.
CO-4: To understand the different kinds of laws in electromagnetism.

Reference Books:

Title	Authors	Publisher
Engineering Physics	V Rajendran	Tata McGraw Hill Education
Engineering Physics	Khan B. H	Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006

Course Name: Mathematics II

Course Code: SSCH1100

Prerequisite: Differentiation and Basics of Matrices

Teaching and Examination Scheme

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	1	3	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

Objectives of the Course:

To develop understanding of various mathematical concepts To apply precise, logical reasoning to problem solving.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Function and Limit** Function: Concept and Examples, Limit: Concept of Limit, Standard Formulae and related Examples.	06	20
2	**Differentiation** Definition, Rules of, Sum, Product, Quotient of Functions, Chain Rule, Derivative of Implicit functions and Parametric functions, Logarithmic Differentiation. Successive Differentiation up to second order	09	30
Section-II			
3	**Integration** Concept, Integral of Standard Functions, Working Rules of Integration, Integration by Parts, Integration by Substitution Method, Definite Integral and its properties.	09	30
4	**Application of Differentiation and Integration** Velocity, Acceleration, Maxima Minima. Area and Volume	06	20

Course outcomes:

CO-1: Analyze functions and their graphs as informed by limits and derivatives.

CO-2: understand the idea of differentiation from first principles and differentiate power functions.

CO-3: Examine various techniques of integration and apply them to definite and improper integrals.

CO-4: recognize the importance of differentiation and integration for solving problems.

Reference Books:

Title	Authors	Publisher
Engineering Mathematics (third edition)	Anthony croft and others	Pearson Education, 2012
Polytechnic Mathematics	Prakash D S	S Chand
Calculus I: Differentiation and Integration	Dan Hamilton	Hamilton Education Guides

Course Name: Mathematics Tutorial-II

Course Code: SSCH1100

Prerequisite: Mathematics Practical-I

Teaching and Examination Scheme:

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

CE: Continuous Evaluation, ESE: End Semester Examination

Objective(s) of the Course:

The aim of the course is to study of analyze functions and their graphs as informed by limits and derivatives, understand the idea of differentiation from first principles and differentiate power functions, examine various techniques of integration and apply them to definite and improper integrals, recognize importance of differentiation and integration for solving problems.

Course Contents:

Module	Name of Practical/Tutorial	Hours
1.	Function and Limit 1	3
2.	Function and Limit 2	3
3.	Differentiation 1	3
4.	Differentiation 2	3
5.	Differentiation 2	3
6.	Integration 1	3
7.	Integration 2	3
8.	Integration 3	3
9.	Application of Differentiation and Integration 1	3
10.	Application of Differentiation and Integration 2	3

Course outcome:

CO-1: Introductory concepts of Functions & limits

CO-2: Comprehensive coverage of Differentiation

CO-3: Comprehensive coverage of Integration

CO-4: Application of Differentiation & Integration

Reference Books:

Title	Authors	Publisher
Engineering Mathematics (third edition)	Anthony croft and others	Pearson Education,2012
Polytechnic Mathematics	Prakash D S	S Chand
Calculus I: Differentiation and Integration	Dan Hamilton	Hamilton Education Guides

Course Name: Linguistic Proficiency **(A2 Elementary)**
Course Code: CFLS1010
Prerequisite Course:

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	0	0	02	40	60	0	0	0	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- Raise, or ask questions about surrounded information and give answers aboutthemselves and family.
- Understand very simple and daily routine information.
- Read and understand the very simple texts.
- Form simple sentences.
- Identify the usage of grammar and vocabulary.

Section I			
Module No.	**Content**	**Hours**	**Weightage %**
1.	**Grammar & Vocabulary** **Grammar** Present tense (Simple, Continue, Perfect) Past tenses (Simple, to be) Future (Simple); Modals (Can, could, may, might, must, should,would) -ing and the infinitive (Verbs + to + infinitive and verbs + -ing) Identification of parts of speech there and it Questions and word Order **Vocabulary** 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)	09	20

2.	**Listening** Listening to my last holiday Listening to my family, Listening to my flat, Listening to daily routine Listening to shopping habits	04	20
3.	**Speaking** Giving and taking introductions, personal information and family, getting to know each other, greetings, asking for directions and giving directions Raising or asking and answering simple questions	06	20
4.	**Reading** Reading of the content of the simpler texts like labels, posters, catalogs, ads, menus, schedules, and guess the unknown words on a contextual basis. Reading of information around us such as announcements, simple advertising, places andactivities, job vacancies, etc.	04	20
5.	**Writing** Write about themselves Form basic sentences Write about hobbies Writing short personal letters	07	20

Course 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

Course Name: Linguistic Proficiency **(A2)**
Course Code: CFLS1010
Prerequisite Course:

Objectives of the Course:

To help learners to

- Communicate in simple and routine tasks requiring a simple and direct exchange ofinformation 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.

Teaching & Examination Scheme

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	0	0	02	40	60	0	0	0	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

Section I			
Module No.	**Content**	**Hours**	**Weightage %**
1.	**Grammar & Vocabulary** **Grammar** Asking Questions—Question forms Present simple vs present continuous Past simple—Form and use However, although, because, so, and time connectors Will vs be going to—future Present perfect or past simple? Much, many, little, few, some, any—quantifiers Subject and object pronouns, possessive pronounsand adjectives Prepositions of movement **Vocabulary** Families, Restaurants and leisure venues, Personality, Biographical information, Buildings andmonuments, 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)	09	20

2.	**Listening** Listening to factual information, Listening to the weather forecast, Listening to the content of guidelines, Listening to everyday communication situation ofthe family, shopping, home, work, Listening to simple pair or group talks	04	20
3.	**Speaking** **Giving and taking** 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, **Descriptions of Food and drink** including Cafes, restaurants, and other catering establishments; booking a table, ordering, etc.	06	20
4.	**Reading** **Reading of the content of the simpler texts** like labels, posters, catalogs, ads, menus, job offers, schedules, and guess the unknown words on a contextual basis. **Reading of information around us** such as announcements, advertising, places and activities, job vacancies, etc.	04	20
5.	**Writing** Description of the day Writing messages & experiences Writing on familiar topics Writing short personal letters	07	20

Course 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.

Course Name: Linguistic Proficiency **(B1)**
Course Code: CFLS1010
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	0	0	02	40	60	00	0	0	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives 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.

Section I			
Module No.	**Content**	**Hours**	**Weightage %**
1.	**Grammar & Vocabulary** **Grammar** Functional use of parts of speech Questions—different types Auxiliary verbs Comparatives using the…the… Narrative tenses—all past tenses Position of adverbs and adverb phrases Gerund or infinitive—verb patterns **Vocabulary** Buildings, Appliances, Clothes, Education, Entertainment, Environment, Food and drink, Nature, Personal Feelings, Technology, Weather, Sport (any 3 of these)	09	20

2.	**Listening Skills** Note Taking & Making Audio Comprehension Movie Clips, News, documentaries	04	20
3.	**Speaking Skills** Speaking in various contexts: 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 Choice	06	20
4.	**Reading Skills** Reading Newspaper, Books Summarizing Paraphrasing	04	20
5.	**Writing Skills** Technical Writing: Application, Report Writing, Dialogue Writing, Movie Review, Book Review, Letter Writing	07	20

Course 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 thefamiliar topic.
- Understand most TV news, the majority of films and current affairs programs incommon 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.

Course Name: Linguistic Proficiency **(B2)**
Course Code: CFLS1010
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	0	0	02	40	60	00	0	0	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives 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.

Section I			
Module No.	**Content**	**Hours**	**Weightage %**
1.	**Grammar & Vocabulary** **Grammar** Clauses of contrast, purpose, reason, and result Reflexive and reciprocal pronouns 'There and it' – preparatory subjects Speculation and deduction – modal verbs and expressions Conditionals Gerunds and infinitives Functions **Vocabulary** Travel and Tourism, Health and Medicine, Crime and Law, Education, Personality Adjectives, Collocations and Phrases (any 3 of these)	09	20
2.	**Listening Skills** Understanding the difference between Hearing andListening and Critical Listening. Understanding the various texts in the context of the tone and emotion they portray. Exploring domain-general audio clips and derivingan	04	20

	understanding of the embedded message. Developing the ability to understand the context ofa given situation in a conversation/audio clip.		
3.	**Speaking Skills** Exploration of various forms of speech like extempore, elocution, short speech, etc. Conversational Role Plays and Skits. Elocution to express one's opinion on various subjects given by the Teacher. Collaborative discussion to generate different opinions and responses. Sustaining an interaction; exchanging ideas, expressing and justifying opinions, agreeing and/or disagreeing, suggesting, speculating, evaluating, reaching a decision through negotiation, etc.	06	20
4.	**Reading Skills** Introduction to Reading Vs Critical Reading. Reading and discussion of Short Prose with different writing styles. Understanding vivid descriptions of texts. Description of genres and writing styles that showcase the varying tones and features. Develop an understanding to read between the lines.	04	20
5.	**Writing Skills** Summarizing vs. Paraphrasing Understanding the various texts in the context of the tone and emotion they portray. Understanding the various forms of written documentation like reports and summary. Writing activities that assist students in expressing their emotions and feelings. Writing tasks to generate contrasting ideas, letters for suggestions, letters for the recommendation, essays.	07	20

Course outcomes:

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

- Developing 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.
- Ability to develop and respond to questions and to interact in conversational English.

Assessment methods. Assessment criteria:

Listening – Analyzing audio clips to understand the crux of the clip, A series of eight short unrelated extracts from monologues or exchanges between interacting speakers. There is one multiple-choice question per extract, A monologue or text involving interacting speakers, with a sentence completion task which has 10 questions, Decoding the information given like Details, specific information, stated opinion, five short related monologues, with five multiple- matching questions, A monologue or text involving interacting speakers, withseven multiple-choice questions.

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.

Course Name: Linguistic Proficiency **(B2)**
Course Code: CFLS1010
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	0	0	02	40	60	00	0	0	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives 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.

Section I			
Module No.	**Content**	**Hours**	**Weightage %**
1.	**Grammar & Vocabulary** **Grammar** Clauses of contrast, purpose, reason, and result Reflexive and reciprocal pronouns 'There and it' – preparatory subjects Speculation and deduction – modal verbs and expressions Conditionals Gerunds and infinitives Functions **Vocabulary** Travel and Tourism, Health and Medicine, Crime and Law, Education, Personality Adjectives, Collocations and Phrases (any 3 of these)	09	20
2.	**Listening Skills** Understanding the difference between Hearing and Listening and Critical Listening. Understanding the various texts in the context of the tone and emotion they portray. Exploring domain-general audio clips and derivingan	04	20

	understanding of the embedded message. Developing the ability to understand the context of a given situation in a conversation/audio clip.		
3.	**Speaking Skills** Exploration of various forms of speech like extempore, elocution, short speech, etc. Conversational Role Plays and Skits. Elocution to express one's opinion on various subjects given by the Teacher. Collaborative discussion to generate different opinions and responses. Sustaining an interaction; exchanging ideas, expressing and justifying opinions, agreeing and/or disagreeing, suggesting, speculating, evaluating, reaching a decision through negotiation, etc.	06	20
4.	**Reading Skills** Introduction to Reading Vs Critical Reading. Reading and discussion of Short Prose with different writing styles. Understanding vivid descriptions of texts. Description of genres and writing styles that showcase the varying tones and features. Develop an understanding to read between the lines.	04	20
5.	**Writing Skills** Summarizing vs. Paraphrasing Understanding the various texts in the context of the tone and emotion they portray. Understanding the various forms of written documentation like reports and summary. Writing activities that assist students in expressing their emotions and feelings. Writing tasks to generate contrasting ideas, letters for suggestions, letters for the recommendation, essays.	07	20

Course outcomes:

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

- Developing 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.
- Ability to develop and respond to questions and to interact in conversational English.

Assessment methods. Assessment criteria:

Listening – Analyzing audio clips to understand the crux of the clip, A series of eight short unrelated extracts from monologues or exchanges between interacting speakers. There is one multiple-choice question per extract, A monologue or text involving interacting speakers, with a sentence completion task which has 10 questions, Decoding the information given like Details, specific information, stated opinion, five short related monologues, with five multiple- matching questions, A monologue or text involving interacting speakers, withseven multiple-choice questions.

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

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Environment Pollution & Human Health I
Course Code: SSES2010
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

Objectives of the Course:
To help learners to
- Make aware how the pollution affect the living population.
- Identify the factors contributing to the pollution.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction** Definition of pollution Classification of pollutants.	02	10
2	**Air pollution** Ambient air quality: monitoring and standards (National Ambient AirQuality Standards of India) Air quality index; sources and types of pollutants (primary and secondary); smog (case study); effects of different pollutants on humanhealth (NOx, SOx, PM, CO, CO2, hydrocarbons and VOCs) Control measures; indoor air pollution: sources and effects on human health.	10	25
3	**Water pollution** Sources of surface and ground water pollution; water quality parameters and standards Organic waste and water pollution; eutrophication; COD, BOD, DO Effect of water contaminants on human health (nitrate, fluoride, arsenic, chlorine, cadmium, mercury, pesticides); water borne diseases Concept and working of effluent treatment plants (ETPs).	10	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
4	Soil pollution Causes of soil pollution and degradation Effect of soil pollution on environment	05	20

	Vegetation and other life forms; control strategies.		
5	Noise pollution Noise pollution – sources; frequency, intensity and permissible ambient noise levels Effect on communication, impacts on life forms and humans – working efficiency, physical and mental health Control measures.	03	20

Course outcomes:

CO-1: Students will learn about major air pollutants and their monitoring methods.
CO-2: Students will be able to analyze the contaminants, qualitatively and quantitatively.
CO-3: Students will get to know about the concept and working of wastewater treatment plants
CO-4: Students will learn about the causes of soil pollution.
CO-5: Students will learn about the Noise pollution and its effect.

Reference Books:

Title	Authors	Publisher
Air Pollution: Health and Environmental Impacts	Gurjar, B.R., Molina, L.T. & Ojha C.S.P	CRC Press, Taylor & Francis

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Land & Soil Conservation
Course Code: SSES2210
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

Objectives of the Course:

To help learners to

- Gain knowledge about different types analysis via absorption techniques.
- Develop basic understanding of properties of soil and how the quality of land and soil degrades due toanthropogenic activities.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction** Soil formation; soil profile; soil taxonomy; soil health Ecological and economic importance of soil Need for soil conservation and restoration of soil fertility.	03	10
2	**Fundamentals of soil science** Physical properties of soil; soil colour, soil texture, soil structure soil Water holding capacity, soil organic matter Micronutrients of soil; nitrogen, sulphur, potassium and phosphorus;soil biodiversity Functions of soil Soil organic matter,soil tillage and structural properties of soil	08	20
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	Soil degradation – causes Soil properties relevant to engineering uses, Soil resistance and resilience Nature and types of soil erosion; losses of soil moisture and its regulation, evapotranspiration		

	Soil aeration; Aeration in relation to soil and plant management, wetlands and their poorly aerated soils; soil acidification, and human influenced soil acidification Raising soil pH; Causes of alkalinity, salinity and sodicity Diversity of organisms in soil; influence of organisms on soil fertility; productivity and environmental quality	10	20
4	Land-use changes and land degradation Land resources: types and evaluation. Biological and physical phenomena in land degradation Drivers of land degradation - deforestation, desertification; socio- economic and institutional factors Drivers of land use and land cover change in major geographic zones.	07	30
5	Controlling land degradation Sustainable land use planning; land tenure and land policy Legal, institutional and sociological factors.	02	20

Course outcomes:

CO-1: Students will gain experience with a range of methodologies for measuring soil properties and assessing soil quality.

CO-2: Students will gain knowledge about the color, texture, structure, porosity, acidity, and alkalinity also the living organisms found in the soil and include both micro-and macroplants.

CO-3: Learners will have knowledge of deforestation and desertification and other possible causes.

CO-4: Students will learn the drivers of land use and land cover change.

CO-5: Students will be able to plan Sustainable land use with the help of legal land policy.

Reference Books:

Title	Authors	Publisher
Introductory Soil Science	Dilip Kumar Das	Kalyani Publishers
The Nature and Properties of Soils	Brady, N.C. & Well, R.R	Pearson Education Inc.
Land Degradation	Johnson, D.L.	Rowman & Littlefield Publishers

Course Name: Environment Pollution and Human Health Practical
Course Code: SSES2050
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

Objectives of the Course:

To help learners to

- Identify and describe the factors contributing to the pollution.

Course Contents:

Sr. No	Content	Hours
1	Tutorial based on the types of pollutants present in the environment.	10
2	Present a case study on extreme example of air pollution.	10
3	Working of Effluent Treatment Plant	10
4	Tutorial (Soil Pollution)	10
5	Tutorial (Noise Pollution)	10
6	Case Study	10

Course outcomes:

CO-1: Students will understand various kinds of factors that are directly and indirectly contributing to pollution.
CO-2: Students will have the characteristics and classifications of the pollutants.
CO-3: Students will gain knowledge about the primary, secondary and tertiary treatments of the effluent.
CO-4: Students will have a broader sense of various diseases and their symptoms occurred by the pollutants.

Reference Books(s):

Title	Author(s)	Publisher
Air Pollution: Health and EnvironmentalImpacts	Gurjar, B.R., Molina, L.T. & Ojha C.S.P	CRC Press, Taylor & Francis

Course Name: Physico-Chemical treatment of wastewater
Course Code: SSES2070
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

Objectives of the Course:

To help learners to

- Enable to find the difference between unit operations and unit processes.
- Get aware of the basics of mixing and flocculation and charge neutralization.
- Get familiar with the fundamentals of biological treatment.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction** Characteristics of water and wastewater Types of treatment Conventional water and wastewater treatment	05	10
2	**Preliminary treatment of water and wastewaters**: Screens, purposes, types of screens and head loss in screens Grit chambers: purposes and types of grit chambers	05	15
3	**Primary Treatment of water and wastewater: Coagulation and Flocculation** Colloid characteristics Chemistry of metallic coagulants, polyelectrolytes as coagulant, mixing of coagulants Flocculation: Types of flocculation, types of flocculators. Chemical neutralization	08	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
4	**Sedimentation** Purposes, Sedimentation types, Sedimentation Zones Types of sedimentation tanks, flocculant settling, zone settling andcompression settling	09	30

	Filtration Mechanisms of filtration, hydraulics of filtration, differenttypes of filters, filter clogging, filter washing		
5	**Disinfection** Purposes, Characteristics of ideal disinfection Disinfection methods and mechanisms Factors affecting, Disinfection with chlorine, chlorine dioxide, ozone,ultraviolet radiation	03	20

Course outcomes:

CO-1: Students will be able to differentiate between unit operations in which only physical changes and not chemical changes takes place and Process in which chemical changes take place are considered unit process.

CO-2: Students will have the basic knowledge of different types of Preliminary, Primary, Secondary, and Tertiary treatment processes, its principle, working, and application in water and wastewater treatment.

CO-3: Students will gain knowledge about different types of Physical, Chemical, and biological characteristics of water and wastewater and their importance.

CO-4: Learners will learn about the concepts of different types of treatment plants like STP, WTP, and ETP, their individual applications, and their working principle.

Reference Books:

Title	Authors	Publisher
Water and wastewater Engineering	Metcalf and Eddy	McGraw Hill Education
Engineering Chemistry	Jain and Jain	Dhanpatrai Publication Company

Course Name: Biodiversity & Conservation
Course Code: SSES2130
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

Objectives of the Course:

To help learners to

- Enable the students to understand and appreciate various concepts and issues concerning biodiversity and conservation at local, regional and global levels.
- To encourage students to appreciate the paradigm "think globally, act locally" for a sustainable common future of human kind.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Biodiversity patterns** Spatial patterns: latitudinal and elevation trends in biodiversity; temporal patterns; Seasonal fluctuations in biodiversity patterns; Importance of biodiversity patterns in conservation.	04	25
2	**Biodiversity estimation** Sampling strategies and surveys: floristic, faunal, and aquatic; Qualitative and quantitative methods; Scoring, habitat assessment, richness, density, frequency, abundance, evenness, diversity, biomass estimation; community diversity estimation; Alpha, beta and gamma diversity; molecular techniques: RAPD, RFLP, AFLP; NCBI database, BLAST analyses.	10	20
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Threats to biodiversity** Natural and anthropogenic disturbances; Habitat loss, habitat degradation, and habitat fragmentation; Climate change; pollution; hunting; over-exploitation; Deforestation; Hydropower development Invasive species; Land use changes; Overgrazing; Man wildlife conflict; Consequences of biodiversity loss; Intermediate Disturbance Hypothesis.	08	30

4	In-situ conservation (Biosphere Reserves, National Parks, WildlifeSanctuaries) Ex-situ conservation (botanical gardens, zoological gardens, gene banks, seed and seedling banks, pollen culture, tissue culture and DNA banks) Role of local communities and traditional knowledge in conservation Biodiversity hotspots; IUCN Red List categorization – guidelines,practice and application; Red Data book Ecological restoration; afforestation; social forestry; agro forestry;joint forest management Role of remote sensing in management of natural resources.	08	25

Course outcomes:

CO-1: Students will learn to identify key threats to biodiversity.

CO-2: Students will be having skills to solve issues related to wildlife conservation and management.

CO-3: Students will understand the influence of the environment on plant growth and crop yields, and solutions to improve plant growth and yields.

CO-4: Students will be able to recognize the factors affecting the need to find sustainable approaches for the production of food and fiber crops and ways to implement them.

Reference Books:

Title	Authors	Publisher
The Biodiversity of India	Erach Bharucha	Mapin Publishing Pvt. Ltd
Ecology and Environment	PD Sharma	Rastogi Publications

Course Name: Biodiversity & Ecology Practical
Course Code: SSES2170
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

Objectives of the Course:

To help learners to

- To know about biodiversity of India and world.
- To study and identify biodiversity hotspots.

Course Contents:

Sr. No	Content	Hours
1.	Biodiversity and its importance	10
2.	Biodiversity hotspots in India	10
3.	Biodiversity hotspots in World	10
4.	Biodiversity conservation agencies	10
5.	Presentation	10
6.	Presentation	10

Course outcomes:

CO-1: Learners will learn about genetics, species, and ecosystem biodiversity.
CO-2: Students will have detailed knowledge of the levels and drivers of biodiversity.
CO-3: Students will understand the biogeographical regions with significant levels of biodiversity that is threatened by human habitation.
CO-4: Students will be able to analyze the range of options for biodiversity conservation.

Reference Books:

Title	Authors	Publisher
The Biodiversity of India	Erach Bharucha	Mapin Publishing Pvt. Ltd

Course Name: SSES2090
Course Code: Fundamentals of Air Pollution
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

Objectives of the Course:
To help learners to

- Gain basic knowledge of atmosphere and its properties.
- Gain knowledge about layers of atmosphere and its stability.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Importance of Atmosphere** What is atmosphere, Composition of atmosphere, atmospheric gasesand other constituents, Role of Carbon Dioxide In Atmosphere Structure of Atmosphere air Pollution, Sources of Air pollution Episodes Units of measurement of Air Pollution, Ambient Air QualityStandards.	06	30
2	**Elemental Properties of Atmosphere** Elemental properties of atmosphere Chemical and photochemical reactions Ozone layer depletion	04	15
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Meteorology** Introduction, solar radiation, wind circulation, lapse rates, stability conditions, wind velocity profile maximum mixing depth, wind rose diagram, turbulence, general characteristics of stack plumes. Winds and their formation, measurement of atmospheric pressure, gradient wind, turbulence, local winds, atmosphericcirculation.	15	30

4	**Atmospheric dispersion** Atmospheric dispersion, atmospheric stability, role of atmosphericstability in dispersion Plume behavior Mixing height, stack height, Gaussian plumedispersion model Wind rose.	05	25

Course outcomes:

CO-1: Students will gain knowledge about the composition, and structure of the atmosphere and various air pollution episodes that occurred.

CO-2: Students will get familiar with the chemical and photochemical elements occurring in the atmosphere, ozone layer depletion, and its effect on the atmosphere.

CO-3: Students will understand the meteorology of the atmosphere like lapse rate, stability of atmosphere, solar radiation, wind circulation, wind velocity profile maximum mixing depth, etc.

CO-4: Students will get a clear understanding of atmospheric dispersion, plume behavior, mixing height, stack height, Gaussian plume dispersion model and wind rose.

Reference Books:

Title	Authors	Publisher
Air pollution	Rao M.N. and Rao H.V.N	TMH PUB

Course Name: Instrumentation & Analytical Techniques I
Course Code: SSES2190
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

Objectives of the Course:

To help learners to

- Gain knowledge about different types analysis via absorption techniques.
- Develop basic understanding of properties of soil and how the quality of land and soil degrades due to anthropogenic activities.

Course Contents

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**UV-Visible** Introduction, Nature of electronic excitations, Origin of UV band structure, fundamentals of absorption spectroscopy, Lambert's and Beer's Law, Beer- Lambert Law, Limitation of the law Colorimeter, Instrumentation for UV/Visible radiations: source, filter, mono-chromators, sample holder, slits, detector, recorder, transition associated to UV-spectra (Chromophore, Auxochromes, Bathochromic shift, Hypsochromic shift, Hyperchromic effect, Hypochromic effect, Hyperconjugation) Applications, Numerical based on Lambert-Beer's Law.	10	33
2	**Flame Photometer** Introduction, Principle, Block diagram and components of Instrument (Source, atomizer, monochromator, receivers) Working procedure, Source of error in flam photometry, Handling ofsamples Applications, Advantages and Disadvantages	5	17
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**

3	**Atomic Absorption Spectroscopy (AAS)** Principle, Instrument, Continuous sources and line sources, Flames,Flame atomizers, Non-flame atomizers (furnaces) Instrumentation, Spectrophotometer (Single beam and double beam) Interference in AAS, Sample preparation and Injection method, Effect of solvents Data analysis via calibration curve method Quantitative Analysis with AAS, Applications, Numerical	8	27
4	**Assessment of Analytical Data** Accuracy, Precision, Sensitivity, Errors, Classification of Errors, Absolute and Relative Error, Minimization of Error Uncertainty, Propagation of Uncertainty, Significant Figure, Roundingoff, Mean, Median, Mode, Range Deviation, Sample Standard Deviation, Population Standard Deviation, Variance, Relative Standard Deviation Distribution of measurements, Normal distribution curve, Reliability of Results (Q-test) Comparison of Results: Student's t-test and F-test, Linear Regression and Calibration Curves **Numericals based on above topics.**	**7**	**23**

Course outcomes:

CO-1: Students will be able to analyze various pollutants like dyes and water parameters by using UV-Vis spectrometry.

CO-2: Students would be able to apply their knowledge for the analysis of various elements present in the environmental samples.

CO-3: Students would be able to apply theoretical knowledge in handling and operating the AAS. It will help in the analysis of metallic samples in the solid and liquid samples.

CO-4: Students would be able to apply statistical tools for the relevant information with minimum error. It will help them to apply it for research purposes.

Reference Books:

Title	Authors	Publisher
Introduction to Spectroscopy	Donald L. Pavia, Gary M. Lampman, George S. Kriz	Brooks Cole
Principles of Instrumental Analysis (6^{th}Edition)	Douglas A. Skoog, F James Holler, Stanley R. Crouch	Brooks Cole
Fundamental of Analytical Chemistry	Douglas A. Skoog, Donald M. West, F James Holler, Stanley R. Crouch	Cengage
Analytical Chemistry for Technicians(4^{th} Edition)	John Kenkel	CRC press, Taylor & Francisgroup
Modern Analytical Chemistry	David Harvey	McGraw-Hill Higher Education

Course Name: Analytical Techniques Practical
Course Code: SSES2230
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

Objectives of the Course:

To help learners to

- Elaborate knowledge about different types analysis via absorption techniques.
- Help develop basic understanding of properties of soil and how the quality of land and soil degrades due to anthropogenic activities.

Course Contents:

Sr. No	Content	Hours
1.	Photometric titration of (Cu^{2+} + Ca^{2+}) in a mixture	6
2.	pK_{In} of indicator and determination of Methyl red	6
3.	To determine metal to ligand ratio for Fe - 1, 10-Phenanthroline complex using mole ratio methods	6
4.	Determine the Fe^{2+} content in a given sample of cement by spectrophotometrically	6
5.	Flame photometric determination of inorganic salts	6
6.	Dry Lab: Data analysis and graph plotting by Microsoft Excel	12
7.	Characterization of soil from a local area	6
8.	Determination of soil pH and moisture content	6
9.	Mapping the soil uses in major geographic zones	6

Course outcomes:

CO-1: Students will be able to operate Spectrophotometer & Flame photometer to analyze various parameters.

CO-2: Students will gain knowledge about the color, texture, structure, porosity, acidity, and alkalinity also the living organisms found in the soil and include both micro-and macro plants.

CO-3: Students will be able to do Data analysis and graph plotting by using Microsoft.

CO-4: Learners will have knowledge of different kind of soil and their uses respectively.

Reference Books:

Title	Authors	Publisher
Handbook of Environmental Analysis	Pradyot Patnaik	CRC Press
Standard Methods for the Examination of water and wastewater	Arnold E. Greenberg	American Water Works Association

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	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

Objectives of the Course:

To help learners

- To achieve expertise with the technicalities of creativity and problem solving.
- Advance an assertiveness for innovation.
- Advance creative thinking skills using shaft of learning components leading to understanding of plans of creativity, problem solving and innovation, Discuss uses of the concepts of creativity and problem-solving skills in personal, social, academic, and profession life.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction to Creativity, Problem Solving and Innovation** Definitions of problem solving Creativity and Innovation Need for Problem Solving and Innovation & Scope of creativity Types and Styles of Thinking Strategies to develop Creativity, Problem Solving and Innovationskills	8	17
2	**Questioning and Learning** Introduction to questioning, learning and visualization and its strategies Sources and methods of questioning and learning Finding perspective, Visualizing thinking, Mind Mapping	7	16
3	**Creative Thinking and Problem Solving** Need of creative thinking Cracking Creativity - Reversals, Reversing Perspective, seeing all sides, Looking in other world Finding what you are not looking for and following up Fishbone diagram SCAMPER Technique	8	17

Section-II			
4	**Logic and Reasoning** Basic concept of Logic Divergent Vs Convergent Thinking, Inductive Vs Deductive thinking Fusion of ideas for problem solving Moral Reasoning Improvisation	8	17
5	**Practices of Playing** Collaboration and Brainstorming The Spirit of Koinonia QFT Model Connecting the unconnected Making novel combinations	7	16
6	**Review Strategies for Creative problem-solving methods** A Heuristic technique Problem-Solving Strategies: Why Bother? Five building blocks as per Fogler& LeBlanc. Strategy for critical thinking for Choosing Lateral Thinking Six thinking hats by Edward de Bono Design Thinking	7	17

Text Books:

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

Reference Books

Title	Authors	Publisher
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 thecreative 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 ThinkingPuzzle 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
	3	Problem Solving Activity (Individual)	10
		Presentation (Learning Outcomes)	15
Grand Total			100

Course Outcomes:

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

- establish creativity in their day-to-day actions and educational output
- solve all types of problems with an optimistic and an impartial attitude
- reflect innovatively and work towards problem solving in a tactical way
- initiate different and advanced practices in their selected field of profession

Course Name: Foreign Language 1 (German
Course Code: CFLS3010
Prerequisite Course/

Teaching & 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

Objectives of the Course:

- To develop and integrate the use of the four Language skills i.e. listening, speaking, reading and Writing.
- To use the language effectively and appropriately on topics of everyday life situations.
- To develop an interest in the appreciation of French.
- To develop an intercultural awareness.
- 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.
- To appreciate the language as an effective means of communication.
- To understand language when spoken at normal conversational speed in everyday lifesituations.
- To understand the basic structural patterns of the language, vocabulary andconstructions.

Course Contents:

Section I- Theory			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	Introduction to French Alphabets French accents Greetings What are the similarities and differences betweenEnglish and French? Numbers in French Cardinal numbersOrdinal numbers Vocabulary part-1 The days of the week The months of the year Seasons Directions	3	10
2	Vocabulary part-2 Family Colours Day/time indicators	3	10

	Body parts Clothing School subjects Places Common expressions		
3	French grammar And verbs: Verb etre(to be) Verb avoir(to have)	**3**	**30**
4	Regular verbs First group verbs('ER' group) Regular verbs Second group verbs('IR' group) Irregular verbs Third group verbs du ,de l',de la./au,aux(article contactive and paritive.) possessive prorouns(mon,ma,mes..etc)	**12**	**50**
5	Telling time in French Basic introduction	**3**	

Section I- Practical

Module	**Content(delf book)**	**Hours**	**Weightage (%)**
1	Reading	1	10%
2	Writing	1	10%
3	Speaking	2	10%
4	Listening	1	10%
5	Role plays		15%

Course Outcomes:

Students will be able to

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

Title	**Author/s**	**Publication**
Nameste FrenchG.MAUGER MON LIVRE FRANCAIS	Yoshita dalal	9 series publications
DELF A1	Bruno GiraedeauNelly Mous	Goyal publishers

Web Material/Links:

- **Ciep.com**
- **www.youlearnfrench**

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Integrated Personality Development Course 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	0	100

CE: Continuous Evaluation, ESE: End Semester Examination

Objectives 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	

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 theContinuous 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), wewould 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 relationshipsalong 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

Course Name: Global Communication Skills
Course Code: CFLS1020

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
02	00	00	02	40	60	00	00	--	--	100

CE: Continuous Evaluation, ESE: End Semester Exam

Objectives of the Course:

To help learners to

- hone basic communication skills by exposing them to the key communicationtechniques.
- 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 team work and give practice in group communication with reference to group dynamics.

Course Contents:

Module	Content	Hours	Weightage %
1	**Introduction to Communication Skills** Concept and Process of Communication Types of Communication Principles of Effective Communication Barriers to Communication	10	33
2	**Interpersonal Organizational Communication** Styles and Flows of Communication Essentials of Organizational Communication Kinesics, Proxemics and Chronemics	06	20
3	**Team/ Group Dynamics and Leadership** Types of Groups and Essentials of Group Work and Networking Concept and Types of Leadership Traits of an Effective Leader	06	20
4	**Presentation Skills** Modes, Means and Purposes of Presentation Audience Analysis and Content Organization Visual aids and Nuances of Delivery Non-Verbal Cues for Effective Presentation	08	27

Course Outcomes:

After completion of the course, the student 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.

Text Books:

Title	Author/s	Publication
Practical Techniques to Develop Communication Skills	Parul Popat & Kaushal Kotadia	Pothi Prakashan, 2015

Reference Books:

Title	Author/s	Publication
Communication Skills	Parul Popat & 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://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.

Sem-4

Course Name: SSES2020
Course Code: Green Technology I
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

Objectives of the Course:

To help learners to

- Understand role of green technologies in realizing the goal of sustainable development and while focusing on community participation to tap the economic benefits associated with switching to green technologies.
- Gain basic knowledge of air pollutants and their causes.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction** Definition and concepts Green technology, green energy, green infrastructure, green economy,and, green chemistry Sustainable consumption of resources Individual and community level participation such as small-scale composting pits for biodegradable waste, energy conservation Encouraged use of public transport instead of private transport.	05	15
2	**Green technologies** Green technologies in historical and contemporary perspectives Successful green technologies: wind turbines, solar panels 3 R's of green technology: recycle, renew and reduce Paradigm shift from 'cradle to cradle' to 'cradle to grave'	07	15
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Green infrastructure, planning and economy** Green buildings History of green buildings Need and relevance of green buildings over conventional buildings Construction of green buildings	13	40

	Eco-mark certification Green planning: role of governmental bodies Concept of green cities Waste reduction and recycling in cities Public transportation for sustainable development, green belts Introduction to UNEP's green economy initiative.		
4	**Applications of green technologies** Increase in energy efficiency Cogeneration motor system optimization Oxy-fuel firing Isothermal melting process Energy efficient fume hoods Compact fluorescent lights (CFLs)	05	20

Course outcomes:

CO-1: Students will understand the concept and terminologies like Green Technology, Green energy, green chemistry, Green Infrastructure, and Green Economy and their application to a sustainable lifestyle.

CO-2: Students will understand the role of green technologies and will understand the importance of applying the same in realizing the goal of sustainable development.

CO-3 Students will gain knowledge regarding developing a green community as per the guidelines of LEEDS and GRIHA in order to move one more step toward a sustainable lifestyle.

CO-4: Students will understand the modern applications and role of technologies like Increase in energy efficiency, Cogeneration, motor system optimization, Oxy-fuel firing, Isothermal melting process, Energy-efficient fume hoods, Compact fluorescent lights (CFLs).

Reference Books:

Title	Authors	Publisher
Green Technologies: For a Better Future	Arceivala, S.L.	Mc-Graw Hill Publications.

Course Name: Green Technology Practical
Course Code: SSES2060
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

Objectives of the Course:

To help learners to

- Understand the concept of green technologies and recent inventions in the field.
- Understand the role of green technologies in realizing the goal of sustainable development and while focusing on community participation to tap the economic benefits associated with switching to green technologies.

Course Contents:

Sr. No	Content	Hours
1	Study REDD+ initiative	10
2	Explain working of Compact Fluorescent Lights (CFLs)	10
3	Study recent invention on Green Nanotechnology	10
4	Study UNEP's green economy initiative	10
5	Case Study on Photodegradable Plastic Bags	10
6	Write a Paper on advanced environmentally friendly technologies	10

Course outcomes:

CO-1: Students will understand the concept and terminologies like Green Technology, Green energy, and Green Economy and their application for a sustainable lifestyle.

CO-2: Students will gain knowledge regarding recent inventions like CFL, Nanotechnology, and advanced technologies in order to achieve the green technology motive.

CO-3: Students will study various initiatives ongoing for the sake of achieving the agenda of green technology.

CO-4: Students will understand the role of Green Technology while focusing on community participation to tap the economic benefits associated with switching to green technologies.

Reference Books:

Title	Authors	Publisher
Green Technologies: For a Better Future	Arceivala, S.L.	Mc-Graw Hill Publications.

Course Name: Air pollution & Control
Course Code: SSES2100
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

Objectives of the Course:

To help learners to

- Gain basic knowledge of air pollutants and their causes.
- Understand about the various control mechanism used for control of particulates.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Air Pollutants** Sources & their inventory; Particulate matter; Carbon dioxide, carbon monoxide, Sulphur oxide Effects of hydrocarbon; Oxide of nitrogen; Photochemical oxidants, asbestos and metals on materials and health.	06	20
2	**Effects of Air Pollution** Effects of air pollution on human, vegetation, animals and materials.	02	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Control of Sulfur oxide and Nitrogen oxide** Sources of Sulphur dioxide, sources of Nitrogen dioxide Use of scrubbers Approaches for Limiting Emission Selection of Technology and Modifications and Monitoring	04	15
4	**Mobile sources** IC engine and cycle, A/F ratio Sources of air pollutants Control by process change Engine design change, engines Fuel change and CNG.	08	20

5	**Control of Particulates** Particulate control mechanisms Gravity bag filters electrostatic precipitator Noise pollution: sources, effects and control Odourproblem: causes and control.	10	20

Course outcomes:

CO-1: The student will be able to classify and identify the sources of air pollutants.

CO-2: Students will learn the effects of air pollutants on human health and the environment.

CO-3: Students will get detailed knowledge about the major air pollutants sulphur oxide and nitrogen oxide and their control measures.

CO-4: Students will get familiar with various control equipment for existing air pollutants with their designs.

CO-5: Students will learn about the particulate control mechanisms, and noise and odor pollution.

Reference Books:

Title	Authors	Publisher
Air Pollution	Rao & Rao.	Tata McGraw-Hill Publishing Ltd
Air Pollution, its origin and control	Wark& Warner	Addison-Wesley, 1998
Water and wastewater engineering :treatmentand Reuse	Metcalf and Eddy	McGraw-Hill Education, 2002

Course Name: Biological Process for Wastewater Treatment
Course Code: SSES2080
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

Objectives of the Course:

To help learners to

- Gain basic biological treatment process and their efficiencies.
- Get aware of the role of microorganism in the biological treatment processes.
- Gain basic knowledge of air pollutants and their causes.
- Understand about the various control mechanism used for control of particulates.

Course Contents:

Section-I			
Module	**Content**	**Hours**	**Weightage (%)**
1	**Overview of Biological Wastewater Treatment** Objectives of Biological Treatment Role of microorganisms in wastewater treatment Types of Biological processes for wastewater treatment. Types of aeration systems	03	10
2	**Composition and Classification of microorganism** Cell components, Cell composition Environmental factors, Carbon and energy sources for microbialgrowth Nutrient and growth factors requirement Bacterial Growth and Energetics	03	15
Section-II			
3	**Microbial growth kinetics** Microbial Growth Kinetics Terminology Rate of utilization of soluble substrate, Rate of Biomass Growth with Soluble Substrate, Rate of Oxygen Uptake	12	35

	Effects of Temperature, Total Volatile Suspended Solids Active Biomass, Net Biomass Yield and Observed Yield,		
4	**Aerobic Biological Oxidation Suspended growth treatment process** Processes for BOD removal and Nitrification; Rotating Biological Contractors Trickling Filter Activated sludge, Suspended Growth Biological Nitrogen Removal Fluidized Bed Bioreactors Upflow Sludge Blanket Reactor	12	40

Course outcomes:

CO-1: Students will have knowledge of the biological treatment of effluent, its types, and the role of microbes in this process.

CO-2: Students will understand the importance of bacteria in the secondary wastewater treatment process.

CO-3: Students will learn about microbial growth kinetics in detail.

CO-4: Learners will have detailed knowledge of Rotating Biological Contractors, Trickling filters, Fluidized Bed Bioreactors, Up-flow Sludge Blanket Reactors, and many more.

Reference Books:

Title	Authors	Publisher
Air Pollution	Rao & Rao.	Tata McGraw-Hill Publishing Ltd
Air Pollution, its origin and control	Wark& Warner	Addison-Wesley, 1998
Water and wastewater engineering: treatmentand Reuse	Metcalf and Eddy	McGraw-Hill Education, 2002

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Air & Water Pollution Practical II
Course Code: SSES2120
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

Objectives of the Course:

To help learners to

- Gain basic biological treatment process and their efficiencies.
- Get aware of the role of microorganism in the biological treatment processes.
- Gain basic knowledge of air pollutants and their causes.
- Understand about the various control mechanism used for control of particulates.

Course Contents:

Sr. No	Content	Hours
1.	Determination of BOD of wastewater Sample	10
2.	Determination of COD of wastewater Sample	10
3.	Determination of Sulphates and Nitrates.	10
4.	Study of jar test for different coagulant dose	10
5.	Determine the particulate matter (PM2.5) in ambient air	10
6.	Study of Stack monitoring kit	05
7.	Tutorial: Determination of Biomass and Solids Yields	05

Course outcomes:

CO-1: Students will learn to analyze the physicochemical characteristics of wastewater.
CO-2: Learners will get basic knowledge of the types of equipment and instruments used in the Environmental science laboratory.
CO-3 Students will learn to check the concentration of particulate matter suspended in the air.
CO-4: Students will learn to test the pollution indicating parameters (i.e., DO, BOD, COD) of wastewater.

Reference Books:

Title	Authors	Publisher
Air Pollution	Rao & Rao.	Tata McGraw-Hill Publishing Ltd
Air Pollution, its origin and control	Wark& Warner	Addison-Wesley, 1998
Water and wastewater engineering: treatmentand Reuse	Metcalf and Eddy	McGraw-Hill Education, 2002

Course Name: Environment Ethics, Law & Policy I
Course Code: SSES2140
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

Objectives of the Course:

To help learners to understand the legal structure of India and fundamentals of environmental legislation and policy making.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction** Constitution of India Fundamental rights; fundamental duties Union of India; union list, state list, concurrent list; legislature State assemblies Judiciary; panchayats and municipal bodies National Green Tribunal	05	20
2	**History of environmental legislation and policy** Ancient period: worship of water, air, trees Mauryan period: Kautilya's Arthashastra, Yajnavalkyasmriti andCharaksamhita Medieval period: forests as woodland and hunting resources during Mughal reign British India: Indian Penal Code 1860 Forest Act 1865 Fisheries Act 1897 Independent India: Van Mahotsava 1950, National Forest Policy 1952 Orissa River pollution and prevention Act 1953.	10	20

Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Environmental legislation** Legal definitions (environmental pollution, natural resource Biodiversity, forest, sustainable development) Article 48A (The protection and improvement of environment andsafeguarding of forests and wildlife) Article 51 A (Fundamental duties)	05	20
4	**Legislative Instruments** The Indian Forest Act 1927 The Wildlife (Protection) Act 1972 The Water (Prevention and Control of Pollution) Act 1974 The Forests (Conservation) Act 1980 The Air (Prevention and Control of Pollution) Act 1981 The Environment (Protection) Act 1986 Motor Vehicle Act 1988 Biodiversity Act 2002	10	40

Course outcomes:

CO-1: Students will have a proper understanding of fundamental rights and duties.

CO-2: Students will gain knowledge regarding the importance of air, water, and trees from the ancient period of India.

CO-3: Students will understand the judiciary system of the Indian constitution.

CO-4: Students will learn about various acts for environmental protection and improvement.

Reference Books:

Title	Authors	Publisher
Environmental Law and Policy	Aruna Venkat	PHI Learning Private Ltd.
Environmental Law and Policy in India	Shyam Divan and Armin Rosencranz	Oxford University Press, New Delhi

Course Name: Environment Ethics, Law & Policy Practical
Course Code: SSES2180
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

Objectives of the Course:
To help learners to understand the legal structure of India and fundamentals of environmental legislation and policy making.

Course Contents:

Sr. No	Content	Hours
1.	Overview of Kyoto Protocol and its amendments	10
2.	Overview of Montreal Protocol and its amendments	10
3.	Key aspects of Paris Agreement	10
4.	The Dehradun Valley Litigation: Case Study	10
5.	Pollution of River Ganga: Case Study	10
6.	Oleum Gas Leak in Shriram Factory: Case Study	10

Course outcomes:
CO-1: Students will understand the global agreement targeting greenhouse gas emissions and climate change mitigation.
CO-2: Students will study about the global agreement to protect ozone layer.
CO-3: Students will have a proper understanding of the important aspects of Paris Agreement.
CO-4: Students will learn about important case studies pertaining to Environment.

Reference Books:

Title	Authors	Publisher
Environmental Law and Policy	Aruna Venkat	PHI Learning Private Ltd.
Environmental Law and Policy in India	Shyam Divan and Armin Rosencranz	Oxford University Press, New Delhi

Course Name: Instrumentation & Analytical Techniques II
Course Code: SSES2201
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

Objectives of the Course:

To help learners to

Acquire the fundamental knowledge about chromatographic and spectroscopy techniques and its application inthe field of Environment Science via this course.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Planar Chromatography** (Principles, Instrumentation and application) Classification of chromatography a) Paper Chromatography(PC) b)Thin Layer Chromatography(TLC) c) HPTLC	6	25
2	**Gas Chromatography (GC)** 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	8	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**

3	**Liquid Chromatography** Limitations of conventional liquid Chromatography Principle and diagram of instrument Components of instrument Column of HPLC Detectors (UV absorption, RI detector) Applications of HPLC.	8	25
4	**Spectroscopy** Principles, Instrumentation and applications Circular Dichroism(CD) Fluorescence Infrared(IR) ^{1}H NMR (ProtonNMR)	8	25

Course outcomes:

CO-1: Students will understand the concepts, Principles, Instrumentation, Working, Application, Advantages, and Disadvantages of Planar chromatography.

CO-2: Students will understand the concepts, Principles, Instrumentation, Working, Application, Advantages, and Disadvantages of Gas chromatography and HPLC.

CO-3: Students will understand the concepts, Principles, Instrumentation, Working, Application, Advantages, and Disadvantages of Spectroscopy methods like NMR, IR, Fluorescence, and Circular Dichroism.

CO-4: Students will acquire fundamental knowledge about chromatographic and spectroscopy techniques and their application in the field of Environment Science.

Reference Books:

Title	Authors	Publisher
Introduction to Spectroscopy	Donald L. Pavia, Gary M. Lampman, George S. Kriz	Brooks Cole
Principles of Instrumental Analysis (6thEdition)	Douglas A. Skoog, F James Holler, Stanley R. Crouch	Brooks Cole
Fundamental of Analytical Chemistry	Douglas A. Skoog, Donald M. West, F James Holler, Stanley R.Crouch	Cengage
Analytical Chemistry for Technicians(4th Edition)	John Kenkel	CRC press, Taylor & Francis group
Modern Analytical Chemistry	David Harvey	McGraw-Hill Higher Education

Course Name: Bio-Analytical Techniques Practical
Course Code: SSES2240
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

Objectives of the Course:
To help learners to
Acquire the fundamental knowledge about chromatographic and spectroscopy techniques and its application.

Course Contents:

Sr. No	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 drugs	06
4.	Analytical techniques tutorial	10
5.	GC tutorial	10
6.	HPLC tutorial	10
7.	Visit to sophisticated instrumentation lab	12

Course outcomes:
CO-1: Students will learn about different separation techniques like paper chromatography, TLC, HPTLC, GC, and LC.
CO-2: Students could perform the separation of organic molecules by paper chromatography.
CO-3: Students will learn which samples are suitable for LCMS and which for GCMS. Also, students could handle GCMS instruments on their own after knowing the principle and working.
CO-4: Students will have distinctive features in their minds about conventional liquid chromatography and HPLC, their principle, working, instrumentation and applications.

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
Introduction to Spectroscopy	Donald L. P., Gary M. L., George; S. K., James A. V.	Brooks Cole

Course Name: Introduction to Industries
Course Code: SSES2260
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

Objectives of the Course:

The students will acquire the fundamental knowledge of various Industries like food, chemical, pharmaceutical, agriculture-based industries etc. and its application in the field of Environmental Science via this course

Course Contents:

Section-I			
Module	**Content**	**Hours**	**Weightage (%)**
1	**Food Based Industries** A visit to Food based industry and acquaintance with instruments/ equipment's/ processes/ technology employed.	6	25
2	**Pharmaceutical Industries** A visit to Pharmaceutical industry and acquaintance with instruments/ equipment's/ processes/ technology employed.	8	25
Section-II			
3	**Agriculture/Dairy based Industries** A visit to Agriculture based industry and acquaintance with instruments/ equipment's/ processes/ technology employed.	8	25
4	**Chemical Industries** A visit to Chemical industry and acquaintance with instruments/ equipment's/ processes/ technology employed	8	25

Course outcomes:

CO-1: Students will understand the various operations involved in industries.

CO-2: Students will have the opportunity to gain knowledge about the functions of diverse instruments utilized in industries.

CO-3: Students will be able to determine the market value of different products and identify scope for entrepreneurship.

CO-4: Students will understand complex processes on different scales , used for multidisciplinary approaches.

Reference Books

Title	Authors	Publisher
Industrial Waste Water Treatment	A.D. Patwardhan	PHI Learning Private Ltd
Advances in Industrial Wastewater Treatment	P.K Goel	ABD Publisher

Course Name: Foreign Language 2
Course Code: CFLS3021
Prerequisite Course/s: CFLS3010 Communication Skills (Foreign Language) French

Teaching & 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

ObjectiveS of the Course:

- To develop and integrate the use of the four Language skills i.e. listening, speaking,reading and Writing.
- To use the language effectively and appropriately on topics of everyday life situations.
- To develop an interest in the appreciation of French.
- To develop an intercultural awareness.
- 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.
- To appreciate the language as an effective means of communication.
- To understand language when spoken at normal conversational speed in everyday lifesituations.
- To understand the basic structural patterns of the language, vocabulary and constructions.

Section I – Theory			
Unit	**Content**	**Hours**	**Weightage (%)**
1	French grammar INTRODUCTION TO TENSES FUTUR PASSE COMPOSE Verb etre(to be) Verb avoir(to have)	10	20%
2	Regular verbs IN FUTUR AND PASSE COMPOSE First group verbs(‘ER’ group)	5	25%
3	Regular verbs IN FUTUR AND PASSE COMPOSE Second group verbs(‘IR’ group)	5	25%
4	Irregular verbs IN FUTUR AND PASSE COMPOSE Third group verbs du ,de l’,de la./au,aux(article contactive and paritive.) possessive prorouns(mon,ma,mes..etc)	10	30%

Course Outcomes:

Students will be able to

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

Title	Author/s	Publication
Nameste FrenchG. MAUGER MON LIVRE FRANCAIS	Yoshita dalal	9 series publications
DELF A1	Bruno GiraedeauNelly Mous	Goyal publishers

Web Material/Links:

- **Ciep.com**
- **www.youlearnfrench**

Course Name: Integrated Personality Development Course II
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	0	100

CE: Continuous Evaluation, ESE: End Semester Examination

Objectives 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 – Project Management	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.

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 alongwith 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

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Advanced Wastewater Treatment Technologies I
Course Code: SSES3010
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

Objectives of the Course:

To help learners to

- Acquire knowledge of biological treatment process and their efficiencies.
- Get aware of the role of microorganism in the biological treatment processes.
- Have basic knowledge of air pollutants and their causes.
- Learn about the various control mechanism used for control of particulates.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Overview of Advanced Waste Water Treatment** Introduction Need of Advanced Waste Water Treatment Purpose of Advanced Waste Water Treatment	2	15
2	**Nutrient Removal –Nitrogen & Phosphorus** Nitrogen Removal: Nitrification, Denitrification Simultaneous nitrification and denitrification Phosphorus Removal: Introduction Phosphorus removal by Chemical Precipitation Principles of process, Chemicals applied, Chemistry of phosphorusprecipitation Process configuration Phosphorus removal by Biological Precipitation Principles of the process, Microorganisms involved in the process Process configurations	13	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Adsorption** Introduction Fundamentals of adsorption	10	25

	Type of adsorbents Development of adsorption isotherms: Freundlich, Langmuir BET Activated carbon adsorption Granular carbon adsorption.		
4	**Membrane Filtration** Membrane Process Terminology Membrane Process Classification and operation: Microfiltration, Ultrafiltration, Nano filtration, Reverse Osmosis, Electrodialysis Membrane Configurations: Plate-and- frame module, Spiral-bound module, Tubular module, Hollow-fiber module Membrane Fouling: Modes of membrane fouling, Control of membrane fouling Application of membrane processes: Microfiltration, Ultrafiltration Nanofiltration, Reverse Osmosis	20	35

Course outcomes:

CO-1: Develop knowledge of overview of Advanced treatment process, types and their efficiencies.

CO-2: Understand the advanced techniques like Nitrification, Denitrification, Chemical methods, and EBPR for the removal of nutrients like nitrogen and phosphorous from wastewater in order to discharge water free from such pollutants.

CO-3: Understand the advanced treatment i.e., Adsorption, its fundamentals, working principle, and its application in wastewater treatment.

CO-4: Understand the advanced treatment i.e., Membrane Filtration, its fundamentals, working, construction, principle, and its application in wastewater treatment.

Reference Books:

Title	Authors	Publisher
Industrial Water Pollution Origins, Characteristics and Treatment	Nelson Nemaro	R.E. Krieger Pub. Co (1987
Environmental Engineering	Peary, Rowe & Tclobaloglous	McGraw-Hill Science/Engineering, 1984
Waste Water Engineering: Treatment and Disposal	Metcalf & Eddy	McGraw-Hill Education, 2002

Course Name: Advanced Wastewater Treatment Technologies II
Course Code: SSES3030
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

Objectives of the Course:

To help learners to

- Acquire knowledge of advanced wastewater treatment technologies.
- Get aware of the role of microorganism in the biological treatment processes.

Course Contents

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Membrane Bio Reactor** Introduction MBR Process Description Membrane Bioreactor with Membrane Module Submerged in the Bioreactor Membrane Bioreactor with Membrane Module Situated Outside theBioreactor MB System Features Membrane Module Design Considerations Process Applications: Industrial Wastewater Treatment, Municipal Wastewater	8	30
2	**Ion Exchange** Fundamentals of Ion Exchange Types of Ion Exchange Resins Theory of Ion Exchange, Applications: Removal and recovery of heavy metals, Removal of nitrogen, Removal of phosphorus, Organic chemical removal	8	27
Section-II			
3	**Electrochemical Wastewater Treatment Processes** Introduction Electro-coagulation: Factors affecting Electrocoagulation Electrode materials Reactor configuration Electro-floatation: Factors affecting electro floatation	6	16

	Comparison with other technology, Reactor configuration Electro-oxidation: Electrooxidation process, Reactorconfigurations		
4	**Advanced Oxidation Processes** Theory of advanced oxidation Types of oxidizing agents Ozone based and non-ozone based processes Fenton and photo-Fenton Oxidation Solar Photo Catalytic Treatment Systems	8	27

Course outcomes:

CO-1: Develop an understanding of Advanced wastewater treatment such as Membrane Bioreactor, its fundamentals, working, construction, principle, and its application in wastewater treatment

CO-2: Develop an understanding of Advanced wastewater treatment such as Ion Exchange, its fundamentals, working, construction, principle, and its application in wastewater treatment

CO-3: Develop an understanding of Advanced wastewater treatment such as the Advanced Oxidation Process, its fundamentals, working, construction, principle, and application in wastewater treatment

CO-4: Develop an understanding of Advanced wastewater treatment such as Electrocoagulation, its fundamentals, working, construction, principle, and its application in wastewater treatment

Reference Books:

Title	Authors	Publisher
Industrial Water Pollution Origins, Characteristics and Treatment	Nelson Nemaro	R.E. Krieger Pub. Co
Environmental Engineering	Peary, Rowe & Tclobaloglous	McGraw-Hill Science/Engineering
Waste water Engineering: Treatment and Disposal	Metcalf & Eddy	McGraw-Hill Education

Course Name: Advanced Wastewater Treatment Technologies Practical
Course Code: SSES3050
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

Objectives of the Course:
To help learners to understand and analyze chemical and biological water quality parameters

Course Contents:

Sr. No	Content	Hours
1.	Determine the sodium and potassium in water sample using flame photometer.	06
2.	Determine the chloride in given water sample.(Argentometric method)	06
3.	Determine the fluoride in the given water sample.(Spands-Zirconium colorimetric method)	06
4.	Determine the total hardness of given water sample.(EDTA Titrimetricmethod)	06
5.	Determine the Ca and Mg hardness in given water sample.(Titrimetric method)	06
6.	Determine the nitrite concentration in given water sample.(Spectrophotometric method)	06
7.	Determine the nitrate-nitrogen concentration in given water sample. (Spectrophotometric method)	06
8.	Determine the chlorine demand in given water sample.	06
9.	Determine total MPN in water sample.	06
10.	Determine the fecal coliform in given water sample.	06

Course outcomes:
CO-1: Identify the sodium and potassium by flame photometer, chloride by Argentometric method, and fluoride by Spands-Zirconium colorimetric method in a water sample.
CO-2: Develop skills to operate a Spectrophotometer to analyze nitrite and nitrate-nitrogen concentration in a given water sample.
CO-3: Develop the skill to determine the chlorine demand by oxidation-reduction titration in a given water sample.
CO-4: Understanding of Membrane filtration method for the analysis of fecal coliforms in water.

Reference Books:

Title	Authors	Publisher
Industrial Water Pollution Origins, Characteristics and Treatment	Nelson Nemaro	R.E. Krieger Pub. Co
Environmental Engineering	Peary, Rowe &Tclobaloglous	McGraw-Hill Science/Engineering
Waste water Engineering: Treatment andDisposal	Metcalf & Eddy	McGraw-Hill Education

Course Name: Cleaner Production
Course Code: SSES3190
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

Objectives of the Course:

To help learners to

- Acquire knowledge on environmental pollution caused by industry which can be reduced either by treatment or byprevention at the source.
- Understand reduction or elimination of pollution at the source from industry.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	Cleaner production concept Theory of cleaner production Effect of CP on Industrial economy	02	12
2	Cleaner Methodology Six steps methodology for CP Designation of cleaner production team Analyze process steps Generating cleaner production opportunities Selecting cleaner production solutions Implementation Maintaining cleaner production	08	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	Good House Keeping What is good Housekeeping? What is needed to implement good housekeeping? Check lists for GHK	06	18

4	Energy Audit Methodology Introduction Preliminary or walk-through energy Audit Detailed energy audit	06	20
5	Case Studies	08	25

Course outcomes:

CO-1: Develop an understanding of Cleaner Production concepts, their methodology, and their implementation in various industries in order to reduce waste generated at the source itself.

CO-2: Develop an understanding of the importance and implementation of Good House Keeping in industries.

CO-3: Develop an understanding of Energy Audit concepts, their methodology, and their implementation in various industries in order to reduce energy consumption.

CO-4: Learn about the case studies pertaining to the successful implementation of cleaner production.

Reference Books:

Title	Authors	Publisher
Pollution Prevention-Fundamentals and Practice	PauL L. Bishop	McGraw Hill
Cleaner Production-Environmental and Economic Perspectives	K. B. Misra	Springer
Environmental Management Systems and Cleaner Production	Ruth Hillary	Wiley
Engineers Guide to cleaner Production Technologies	Paul M. Randall	Technomic

Course Name: SSES3210
Course Code: Waste Utilization
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

Objectives of the Course:

To help learners to

- Understand environmental pollution caused by industry
- Gain knowledge of treatment or prevention at the source.
- Understand concepts of recycling, reuse, heat recovery etc.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	Recycling & Reuse: Concept and application	06	24
2	Recycling and reuse of liquid industrial waste in different industries.	06	24
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	Recycling and reuse of solid industrial waste	06	15
4	Waste Heat recovery from flue gases, Waste heat Recovery boilers	06	15
5	Types of heat exchangers	06	22

Course outcomes:

CO-1: Develop an understanding of concepts of recycling, reuse, heat recovery, etc. in various Solid, liquid and gaseous industrial waste in different industries.

CO-2: Develop an understanding of the treatment or prevention of waste generation at the source itself by adopting cleaner production principles.

CO-3: Develop an understanding of environmental pollution like solid waste, effluent generation, and Gaseous emission caused by industry and its prevention.

CO-4: Develop an understanding of various Waste Heat recovery from flue gases, Waste heat Recovery boilers, and types of heat exchangers.

Reference Books:

Title	Authors	Publisher
Waste and By-product Utilization	Deepak Sharma, Neelam Rathore & Kapil Kumar Samar	Apex Publishing House
Solid Waste Engineering	William A. Worrell and P. Aarne Vesilind	Cengage Learning
Introduction to Biomass Energy Conversions	Sergio Capareda	CRC Press, USA
Environmental Engineering (Vol. II) – Sewage Disposal and Air Pollution Engineering.	S. K. Garg	Khanna Publishers, New Delhi

Course Name: Cleaner Production & Waste Utilization Practical
Course Code: SSES3230
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

Objectives of the course:

To help learners to

- Acquire knowledge on Environmental Audit
- Understand and analyze environmental parameters

Course Contents:

Sr. No.	Content	Hours
1.	Working of instruments in Environment Audit Laboratory.	06
2.	Determination of all physical parameters of a given sample	06
3.	Determination of all Chemical parameters of a given sample	09
4.	Determination of microbiological parameters of a given sample.	09
5.	Determination of biological parameters of a given sample	09
6.	Testing a soil sample for all its parameters	09
7.	Case Studies on successful implementation of cleaner production	06
8.	Case Studies on waste utilization from specific industries.	06

Course outcomes:

CO-1: Develop an understanding ofthe working of instruments in the Environment Audit Laboratory like muffle furnace, pH meter, BOD incubator, COD Digester, etc.

CO-2: Identify physical (Temperature, Turbidity, etc.) Chemical (COD, Alkalinity, Acidity, Hardness), Biological (BOD, etc.), and Microbiological (MPN, Total coliform, etc.) parameters of a given waste water sample.

CO-3: Identify a soil sample for all its parameters like moisture content, Bulk density, Specific gravity, etc.

CO-4 Learn case Studies on successful implementation of cleaner production and waste utilization from specific industries in order to understand the practicability in industries.

Reference Books:

Title	Authors	Publisher
Handbook of Environmental Analysis	Pradyot Patnaik	CRC Press
Standard Methods for the Examination of water and wastewater	Arnold E. Greenberg	American Water Works Association

Course Name: Environment Impact Assessment I
Course Code: SSES3070
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

Objectives of the Course:

To help learners to

- Acquire the knowledge of basics of Environmental impact assessment (EIA) tool.
- Understand the procedure of carrying out an EIA of various projects.

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Evolution of EIA** Concepts Methodologies Screening Scoping Base line studies Mitigation	10	25
2	**Methods of Analysis of Impacts on Environment** Adhoc, Checklist Matrix Network Environmental Media quality Index Method Cost Benefit Analysis	15	32
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Public Participation** Concept Public hearing procedure and guidelines Role of NGO in public hearing	10	26
4	**Practical Considerations** Economic development and Environmental degradation	10	17

	Practical consideration in impact assessment		

Course outcomes:

CO-1: Develop an understanding of Screening, Scoping, Baseline study, Impact prediction, and Impact assessment.

CO-2: Develop an understanding of the Matrix and environmental Media Quality Index Method.

CO-3: Express the role of public hearings and their procedure, guidelines, and the role of NGOs in public hearings.

CO-4: Develop an understanding of Economic Development and Environmental degradation.

Reference Books:

Title	Authors	Publisher
Environmental Impact Assessment	Anjaneyulu Yerramilli & Valli Manickam	BS Publications
Handbook of Environment ImpactAssessment	Judith Prett	Wiley-Blackwell

Course Name: Environment Impact Assessment II
Course Code: SSES3090
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

Objectives of the Course:

To help learners to

- Acquire knowledge onthe applications of EIA to different projects.
- Understand comprehensive EIA process

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Location of Industries** Environmental impacts of typical industries Power plants Large projects Present scenario of various government resolutions on selecting thelocation of industries Environmental point of view.	07	23
2	**Case studies of Engineering** Projects like Energy Generation Projects both thermal and Hydal Infrastructure projects Power Transmission Mining etc.	07	23
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**EIA notification by Ministry of Environment and Forest (Govt. ofIndia):** Provisions in the EIA notification Categorization of Industries for seeking environmental clearancefrom concerned authorities Procedure for environmental clearance	10	34

	Procedure for conducting EIA report Rapid and Comprehensive EIA General structure of EIA document Environmental management plan Post environmental monitoring		
4	**Additional studies** Project Benefits Environmental Cost Benefit Analysis EMP Summary EIA notification September 2006 and amendments	06	20

Course outcomes:

CO-1: Develop an understanding of the EIA procedure that is generally well implemented for large infrastructure projects, such as oil installations, power generation projects, mining, and road development.

CO-2: Develop an understanding of each and every step that includes Screening, Scoping, preparing the EIA report, making an application and consultation, Decision making, and Post decision.

CO-3: Develop an understanding of EIA notification by the Ministry of Environment and Forest by the Government of India.

CO-4: Develop an understanding of the General structure of the EIA document that is a compilation of several important project components, including the project description, the assessment of its environmental and social impacts, mitigation measures, and related management and monitoring plans.

Reference Books:

Title	Authors	Publisher
Environmental Impact Assessment	Anjaneyulu Yerramilli & Valli Manickam	BS Publications
Handbook of Environment ImpactAssessment	By Judith Prett	Wiley-Blackwell

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Environment Impact Assessment Tutorials
Course Code: SSES3110
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

Objectives of the Course:

To help learners to

- Get aware about different methods for carrying out environmental impact assessment.

Course Contents:

Sr. No	Content	Hours
1.	List of projects requiring prior environment clearance	6
2.	Adhoc Method of EIA	6
3.	Matrices Method of EIA	8
4.	Network Method of EIA	8
5.	Environmental medium Quality Index method of EIA	8
6.	Visit to a Project site/ Office of EIA expert	8
7.	Checklist Method of EIA	8
8.	A report of EIA is to be prepared by a student on different projects	8

Course outcomes:

CO-1: Learn about different methods for carrying out environmental impact assessment.
CO-2: Develop an understanding of making EIA reports on the project of the interest of their specialization.
CO-3: Develop an understanding of collecting data on Environmental attributes like baseline study of various environment parameters like Air, water, Soil, etc. of project ongoing nearby.
CO-4: Develop an understanding of applications of EIA to different projects including Category A, B1, and B2 projects, and understand the basics of the process to grant EC.

Reference Books:

Title	Authors	Publisher
Environmental Impact Assessment	Anjaneyulu Yerramilli & Valli Manickam	BS Publications

Course Name: Environmental Chemistry
Course Code: SSES3150
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

Objectives of the Course:

To help learners to

- Get aware about various kinds of solid wastes and their general characteristics along with different technologiesfor treatment of these wastes.
- Understand existing legislation for municipal waste, e-waste& hazardous waste and design criteria for hazardouswaste and municipal waste landfill is also an integral part of thiscourse

Course Contents

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Equilibrium Chemistry** Ionization, Complex ions, Solubility product, Common Ion effect Diverse Ion effect Amphoteric hydroxides**.**	03	15
2	**Physical Chemistry** Binary mixtures Solution of solids in liquids Osmosis Dialysis Solvent extraction Catalysis	04	20
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Organic chemistry** Aliphatic compounds Aromatic compounds Heterocyclic compounds	07	20

	Carbohydrates, fats Proteins, amino acids Detergents and oil and waxes, pesticides		
4	**Colloidal Chemistry** General properties of colloids Colloidal dispersions in liquids and air	04	15
5	**Parameters of wastewater analysis** Basic concepts and determination of acidity Alkalinity Chemical oxygen demand Dissolved oxygen Biochemical Oxygen Demand Nitrogen sulphates Grease and oils Volatile acids	12	30

Course outcomes:

CO-1: Develop an understanding of Ionization, Complex ions, Solubility product, Common Ion Effect, and Diverse Ion effect.

CO-2: Develop an understanding of Binary mixtures, Solvent extraction, and Catalysis.

CO-3: Develop an understanding of Aliphatic compounds, aromatic compounds, and heterocyclic compounds.

CO-4: Develop an understanding of the General properties of colloids and Colloidal dispersions in liquids and air.

Reference Books:

Title	Authors	Publisher
Handbook of Solid Waste Management and Waste MinimizationTechnologies	N P Cheremisinoff	Butterworth- Heinemann,
Integrated Solid waste Management	F Dougal and P White	John Wiley and Sons
Solid waste Engineering	Worrell and Vesilind	Cengage Learning
Chemistry for Environmental Engineeringand Science	Sawyer and McCarty	McGraw-Hill Education
Environmental Chemistry	A. K. De	New Age International Limited, Publishers

Course Name: Solid & Hazardous Waste Management
Course Code: SSES3130
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

Objectives of the course:

To help learners to

- Get aware about various kinds of solid wastes and their general characteristics along with different technologies for treatment of these wastes.
- Understand existing legislation for municipal waste, e-waste& hazardous waste and design criteria for hazardouswaste and municipal waste landfill is also an integral part of this course.

Course Contents

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Introduction and characterization of solid waste and hazardouswaste** Municipal waste Plastic waste Biomedical waste E waste Dairy wastes Agricultural wastes Slaughter house wastes Industrial waste and hazardous waste	06	25
2	**Legislation for management of solid waste** Municipal Solid Waste Management Rules, 2000. E- waste management and handling rules, 2011. Major sections of Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.	06	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Solid waste management/treatment** Sustainable waste management practices	09	25

	4R principle for waste management Physico-chemical and Biological methods (aerobic composting andanaerobic digestion) of treating solid wastes. Thermo-chemical methods (Pyrolysis, gasification and incineration)of treating solid wastes. Energy recovery through Refuse derived fuel. Solid waste management in industries. E-waste processing and disposal.		
4	**Solid and hazardous waste disposal** Guidelines and Landfill procedure for disposing hazardous waste. Location and Site selection criteria for hazardous waste landfill. Site investigation, planning and design of hazardous waste landfill. Waste acceptance criteria at hazardous waste landfill. Liner and cover criteria for hazardous waste landfill. Sanitary landfills for municipal waste. Other methods of disposing solid waste.	09	25

Course outcomes:

CO-1: Develop an understanding of ignitability, corrosivity, reactivity, and toxicity of waste and also know about Municipal waste, Plastic waste, Biomedical waste, and E-waste of solid and hazardous waste.

CO-2: Develop an understanding of Municipal Solid Waste Management Rules, 2000.

CO-3: Develop an understanding of different kinds of Physico-chemical and biological methods for solid waste management.

CO-4: Develop an understanding of the Guidelines and Landfill procedure for disposing of hazardous waste.

Reference Books:

Title	Authors	Publisher
Handbook of Solid Waste Management and Waste MinimizationTechnologies	N P Cheremisinoff,	Butterworth-Heinemann
Integrated Solid waste Management	F Dougal and P White	John Wiley and Sons
Solid waste Engineering	Worrell and Vesilind	Cengage Learning

Course Name: Solid Waste and Environmental Chemistry Practical
Course Code: SSES3170
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

Objectives of the Course:

To help learners to

- Acquire knowledge to analyze water quality parameters.
- Acquire knowledge to analyze solid waste parameters.

Course Contents:

Sr. No	Content	Hours
1	To determine the pH of a given sample of hazardous waste by universal indicator method and pH meter method.	**6**
2	To determine the total sulfur content in given sample of solid waste using Bomb Calorimeter.	**6**
3	To determine the moisture content in given solid waste sample.	**6**
4	Determine the total phosphorus in water sample.	**6**
5	To determine the concentration of iron in water sample	**6**
6	Determine the total Fe in water sample.(Spectrophotometric method)	**6**
7	To determine heavy metals (Ni, Pb and Cu) in given sample of hazardous waste through TCLP.	**6**
8	Determination of oil and grease from wastewater samples.	**6**
9	Determination of volatile acids from wastewater.	**6**
10	Analyze actual wastewater samples from industries for all the parameters.	**6**

Course outcomes:

CO-1: Identify water and wastewater quality parameters like Sulphate, Phosphorous, Fe, Oil and Grease, Volatile acids, etc.

CO-2: Identify solid waste parameters like Total Sulphur, Moisture content, etc.

CO-3: Identify various kinds of solid wastes and their general characteristics along with different technologies for the treatment of wastes.
CO-4: Develop an understanding of environmental chemistry like Equilibrium, Physical, Organic, and Colloidal chemistry involved in the field of Environment Science.

Reference Books:

Title	Authors	Publisher
Handbook of Solid Waste Management and Waste MinimizationTechnologies	N P Cheremisinoff	Butterworth- Heinemann
Integrated Solid waste Management	F Dougal and P White	John Wiley and Sons
Solid waste Engineering	Worrell and Vesilind	Cengage Learning
Chemistry for Environmental Engineering andScience	by Sawyer and McCarty	McGraw-Hill Education
Environmental Chemistry	by A. K. De	New Age International (P)Limited, Publishers

Sem-6

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Industrial Wastewater and Control I
Course Code: SSES3080
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

Objectives of the Course:

To help learners to

- Understand the treatment of industrial wastewater
- Acquire the fundamental knowledge about water quality and disposal standards for various industries

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Water Quality Standards for industrial use** Relevant Indian Standards for use of water in Textiles, Paper industry, chemical, Pharmaceutical, soft drink, boiler feed water, cooling tower, and problems of silica, scaling & corrosion, caustic embitterment.	6	24
2	**Oil Pollution** Sources of oil pollution in industries Effects of oil pollution Treatment and removal techniques.	10	26
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Standards for disposal into different Sinks** Difference between criteria & standards Stream standards Effluent standards Relevant Indian standards for disposal in to different sinks Costs of pollution control	8	35
4	**Volume & Strength reduction in industrial waste water** Measures for volume reduction &strength Reduction	6	15

Course outcomes:

CO-1: Develop an understanding ofthe fundamental knowledge about water quality standards for the Textile, Paper & pulp, Sugar, Chemical, and pharmaceutical industries.

CO-2: Develop an understanding of the relevant Indian standards for disposal into different sinks.

CO-3: Develop an understanding of the sources and effects of oil pollution in industries and their Treatment and removal techniques also.

CO-4: Develop an understanding of different measures like Improved process control, Improved equipment design, Use of different or higher quality raw materials, good housekeeping, and Preventative maintenance for volume reduction & strength reduction.

Reference Books:

Title	Authors	Publisher
Industrial Water pollution	Nelson L. Nemerow	Addison-Wesley PublishingCompany
Wastewater Engineering, Treatment & Reuse	Metcalf & Eddy	Tata –Mcraw –Hill edition.
Handbook of Industrial Pollution & Control Vol. I & II	S.C. Bhatiya CBS	Published & distributions

Course Name: Industrial Waste water and Control II
Course Code: SSES3100
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

Objectives of the Course:

To help learners to

- Understand the treatment of industrial wastewater
- Acquire the fundamental knowledge about water quality and disposal standards for various industries

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Pre and Primary treatment for industrial wastewater:** Equalization & proportioning Neutralization Heavy metals removal	4	15
2	**Common Effluent Treatment plants:** Need Concept Treatment technologies	4	15
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Pollution Control in Industries** Manufacturing process, Identification & characterization of sourcesof wastewater Treatment of wastewater including recycling & reuse concepts in Textile industry, pharmaceutical industry; Dairy industry Sugar industry Starch industry Fertilizer industry Tannery, distillery, pulp &paper industry Petrochemical industry, dye & dye intermediate.	8	30

4	**Treatment for strong industrial waste** Incineration Evaporation: Natural & forced evaporation	6	15
5	**Concepts of disposal of wastewater into different sinks** Disposal into river, lake, oceans	8	15

Course outcomes:

CO-1: Develop an understanding of the manufacturing process, sources, characteristics, and treatment of industrial wastewater generated from different industries.

CO-2: Develop an understanding of disposal standards of various environmental parameters for different water bodies.

CO-3: Learn about the concept, working, need, and treatment of CETP.

CO-4: Develop an understanding of Pre and Primary treatment of Industrial wastewater using equalization tank, proportioning, and Neutralization and treatment of strong industrial wastewater using Evaporation and Incineration techniques.

Reference Books:

Title	Authors	Publisher
Industrial Water pollution	Nelson L. Nemerow	Addison-Wesley Publishing Company
Wastewater Engineering, Treatment & Reuse	Metcalf & Eddy	Tata –Mcraw –Hill edition.
Handbook of Industrial Pollution & Control Vol. I & II	S.C. Bhatiya CBS	Published & distributions

Course Name: Industrial Waste water and Control Practical
Course Code: SSES3120
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

Objectives of the Course:
To help learners to
Understand physico-chemical and biological water quality parameters.

Course Contents:

Sr. No.	Content	Hours
1.	Determine the chloride in given water sample.	6
2.	Determinations of lime dose for neutralization of acidic waste andoptimum coagulant dose.	6
3.	Determine the fluoride in the given water sample.	6
4.	Color removal by using Adsorption.	6
5.	Assignments on Water quality Standards for different industries, standards for disposal in to different sinks.	6
6.	To determine the TKN in given water sample	6
7.	Determine total MPN in water sample.	6
8.	Determine the fecal coliform in given water sample.	6
9.	Term paper on Industries including manufacturing process, identification and characterization of sources of waste water/ air pollution, treatment of waste water including waste minimization with flow diagram.	6
10.	Determine the total hardness of given water sample.	6

Course outcomes:
CO-1: Perform the water and wastewater quality parameters like TKN, Fluoride, Chloride, Hardness, etc.
CO-2: Understand the manufacturing process, sources, characteristics, and treatment of industrial wastewater generated from different industries.
CO-3: Perform various Physico-chemical and biological water quality parameters using Jar test apparatus, adsorption, etc.
CO-4: Understand disposal standards of various environmental parameters for different water bodies.

Reference Books:

Title	Authors	Publisher
Standard Methods for the Examination of water and wastewater	Arnold E. Greenberg	American Water Works Association
Handbook of Industrial Pollution & Control Vol. I & II	S.C. Bhatiya CBS	Published & distributions

Course Name: Environmental Biotechnology I
Course Code: SSES3140
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

Objectives of the Course:

To help learners to

- Acquire the fundamental knowledge about bio energy, bioremediation and their application in fields via this course
- Inculcate habit of scientific reasoning to do the task rationally

Course contents

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Energy** 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, oilseed crops Hydrocarbon producing crops.	6	25
2	Bioethanol: Advantages, production, ethanol recovery, future prospect Biodiesel: Advantages, sources as lipid, production, present status Bio-hydrogen: Anaerobic bacteria, photosynthetic algae Biogas technology	8	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Bioremediation** Principles of bioremediation Factors responsible for bioremediation Bioremediation strategies: In situ & Ex situ Microbialbioremediation, phytoremediation	8	25

4	**Special process** Bioleaching, Enrichment of ores by microorganisms (Gold,Copper and Uranium) Metal precipitation, Biopolymers: properties and itsapplication Biopesticides, biofertilizers, composting, vermicompost Environmental significance of genetically modified microbes,plants and animals.	8	25

Course outcomes:

CO-1: Develop an understanding of the role of microorganisms as biotechnological agents.

CO-2: Develop an understanding of tools and techniques in the field of environmental biotechnology.

CO-3: Develop an understanding of the need for alternate energy sources having a low impact on the environment.

CO-4: Develop an understanding of the use of microbial communities in pollution abatement and mitigation of climate change.

Reference Books:

Title	Authors	Publisher
Biotechnology expanding horizons	B.D. Singh	Kalyanipublication
Elements of Biotechnology	P.K. Gupta	Rastogi Publication

PP Savani University
School of Sciences
Syllabus, Teaching and Examination Scheme

Course Name: Environmental Biotechnology II
Course Code: SSES3160
Prerequisite: Nil

Teaching and Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)		
Theory	Practical	Tutorial	Credit	CE	ESE	Total
2	0	0	3	40	60	100

CE: Continuous Evaluation, ESE: End Semester Examination

Objectives of the Course:

To help learners to

- Acquire the fundamental knowledge about bioenergy, bioremediation and their application in fields via this course.
- Inculcate habit of scientific reasoning to do the task rationally

Course Contents:

Section-I			
Module No.	**Content**	**Hours**	**Weightage (%)**
1	**Wastes and pollutants** Sources of wastes and pollutants Types of waste Hazards from wastes Scenario of waste Waste management	6	25
2	**Waste treatment** 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.	8	25
Section-II			
Module No.	**Content**	**Hours**	**Weightage (%)**
3	**Waste water treatment** Characteristics of wastewater Aerobic waste water	8	25

	Treatment: activated sludge and oxidation pond, Anaerobia waste water treatment: UASB and Anaerobic baffledreactor		
4	**Biodegradation of xenobiotics compounds** Types of xenobiotic compound Hazards from xenobiotics Hydrocarbon degradation Biodegradation of halogenated compound Origin of capacity to degrade xenobiotics Biotechnological approaches to degrade xenobiotics	8	25

Course outcomes:

CO-1: Understand the various criteria of waste classification based on toxicity.

CO-2: Create an understanding of various aspects of wastewater. the difference between domestic wastes and industrial effluents.

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

CO-4: Create an understanding of various techniques and norms already employed to manage the wastes.

Reference Books:

Title	Authors	Publisher
Biotechnology expanding horizons	B.D. Singh	Kalyanipublications
Elements of Biotechnology	P.K.Gupta	Rastogi publications

Course Name: Environmental Biotechnology Practical
Course Code: SSES3180
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

Objectives of the Course:

To help learners to

- Acquire the fundamental knowledge about bioenergy, bioremediation and their application in fields via this course.
- Inculcate habit of scientific reasoning to do the task rationally

Course Contents:

Sr. No	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 outcomes:

CO-1: Identify wastewater sample by determining the amount of BOD and COD level present in it.
CO-2: Identify the presence of the organism in the water sample.
CO-3: Identify the presence of microorganisms in food articles.
CO-4: Identify the presence of microorganisms in milk samples.

Reference Books:

Title	Authors	Publisher
Biotechnology expanding horizons	B.D. Singh	Kalyani publications
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