

Shri Rawatpura Sarkar University, Raipur



Examination Scheme & Syllabus

for

Bachelor of Science in Environmental Science

Semester-II

(Effective from the session: 2022-23)



Faculty of Science,
Shri Rawatpura Sarkar University, Raipur
Bachelor of Science in Environmental Science
Semester-II
Examination Scheme
(Effective from the session: 2022-23)

S. No	Course Code	Th/Pr	Subject	Type of Course	Teaching hours per week			TC	Examination Scheme				Total Marks
					L	T	P		Theory		Practical		
									SE*	CA**	SE*	CA**	
1	SSH04201	Th	Water and Water Resources	Core	4	-	-	4	70	30	-	-	100
2	SSH04202	Th	Ecology and Ecosystems	Core	4	-	-	4	70	30	-	-	100
3	SSH04203	Th	Chemistry II: Chemical Energetics, Equilibria & Functional Organic Chemistry	Core	4	-	-	4	70	30	-	-	100
4	SSH04212	Th	Environmental Science	AECC	4	-	-	4	70	30	-	-	100
5	SSH04281	Pr	Environmental Lab Course: III	Core	-	-	4	2	-	-	35	15	50
6	SSH04282	Pr	Environmental Lab Course: IV	Core	-	-	4	2	-	-	35	15	50
7	SSH04283	Pr	Chemistry: Lab Course II	Core	-	-	4	2	-	-	35	15	50
Total								22					550

* Semester Examination, ** Continuation Assessments



Bachelor of Science in Environmental Science
Semester-II
2022-2023

Course Title	WATER AND WATER RESOURCES			
Course Code	SSH04201			
Course Credits	L	T	P	TC
	4	-	-	4
Prerequisites	BASIC BIOLOGY			
Course Objectives	<ul style="list-style-type: none"> The paper introduces students to the hydrological cycle, properties of water, physicochemical and biological water quality assessment and indices, types of water resources, their use and management. It will also highlight the problems associated with water shortages in India and familiarizes students with case studies on international and national conflicts on water 			
Course Contents	<p>UNIT I</p> <p>INTRODUCTION :-Sources and types of water; hydrological cycle; precipitation, runoff, infiltration, evaporation,; classification of water resources (oceans, rivers, lakes and wetlands), Properties of water :Physical: temperature, colour, odour, 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.</p> <p>UNIT II</p> <p>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; river structure and patterns; watershed and drainage basins; importance of watershed and watershed management; rain water harvesting in urban settings.</p> <p>UNIT III</p> <p>WETLANDS AND THEIR :-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, Marine resource management : Marine resources; commercial use of marine resources; threats to marine ecosystems and resources; marine ecosystem and resource management (planning approach, construction techniques and monitoring of coastal zones).</p> <p>UNIT IV</p> <p>WATER RESOURCE IN INDIA:-Demand for water (agriculture, industrial, domestic); overuse and depletion of surface and ground water resources; water quality standards in India; hot spots of surface water; role of state in water resources management., Water resources conflicts : Water resources and sharing problems, case studies on Kaveri and Krishna river water disputes; Multipurpose river valley projects in India and their environmental and social impacts; case studies of dams - Narmada and Tehri dam – social and ecological losses versus economic benefits; International conflicts on water sharing between India and her</p>			



Bachelor of Science in Environmental Science
Semester-II
2022-2023

	neighbors'; agreements to resolve these conflicts UNIT V MAJOR LAWS AND TREATIES :-National water policy; water pollution (control and prevention) Act 1972; Indus water treaty; Ganges water treaty; Teesta water treaty; National River linking plan: ecological and economic impacts. International law.
Course Outcomes	<ul style="list-style-type: none">• Students will understand to the hydrological cycle, properties of water, physicochemical and biological water quality assessment. Students will understand shortages in India and familiarizes and international and national conflicts on water
Text Books	<ol style="list-style-type: none">1. Bansil, P.C. 2004. Water Management in India. Concept Publishing Company, India.2. Brebbia, C.A. 2013. Water Resources Management VII. WIT Press.3. CEA. 2011. Water Resources and Power Maps of India. Central Board of Irrigation & Power. , NJ, Prentice Hall.4. Grumbine, R.E. &Pandit, M.K. 2013. Threats from India's Himalaya dams. Science 339: 3637.
References Books	<ol style="list-style-type: none">1. Loucks, D.P., Stedinger, J.R. &Haith, D. A. 1981. Water Resource Systems Planning and Analysis. Englewood Cliffs2. 2. Mays, L.W. 2006. Water Resources Sustainability. The McGraw-Hill Publications.3. 3. Schward& Zhang, 2003. Fundamentals of Groundwater. John Willey and Sons.4. 4. Suvorov, A.V. 1999. Marine Ecologonomics: The Ecology and Economics of Marine Natural Resource Management. Elsevier Publications.5. Vickers, A. 2001. Handbook of Water Use and Conservation. Water Plow Press.



Bachelor of Science in Environmental Science
Semester-II
2022-2023

Course Title	ECOLOGY AND ECOSYSTEMS				
Course Code	BSCEV103B				
Course Credits	L	T	P	TC	
	4	-	-	4	
Prerequisites	Basic Environmental Studies				
Course Objectives	<ul style="list-style-type: none"> This paper will introduce to the students the basic understanding of ecosystem and its structural and functional aspects. It will explore the interconnectedness among all the biotic and abiotic components of environment and the dynamic nature of the ecological processes in maintaining equilibrium in nature. 				
Course Contents	<p>UNIT I</p> <p>INTRODUCTION :-Basic concepts and definitions: ecology, landscape, habitat, ecozones, biosphere, ecosystems, ecosystem stability, resistance and resilience; autecology; synecology; major terrestrial biomes,Ecology of individuals,Ecological amplitude; Liebig’s Law of the Minimum; Shelford’s Law of 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.</p> <p>UNIT II</p> <p>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; deterministic and stochastic models of population dynamics; rudreal, competitive and stress-tolerance strategies.</p> <p>UNIT III</p> <p>ECOLOGY OF COMMUNITIES :-Discrete versus continuum community view; community structure and organization: physiognomy, sociability, species associations, periodicity, biomass, stability, keystone species, acetone 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.</p> <p>UNIT IV</p> <p>ECOSYSTEM ECOLOGY :- Types of ecosystem: forest, grassland, lentic, lotic, estuarine, marine, desert, wetlands; ecosystem structure and function; abiotic and biotic components of ecosystem; ecosystem boundary; ecosystem function; ecosystem metabolism; primary production and models of energy flow; secondary production and trophic efficiency; ecosystem connections: food chain, food web; detritus pathway of energy flow and decomposition processes; ecological efficiencies; ecological pyramids: pyramids of number, biomass, and</p>				



Bachelor of Science in Environmental Science
Semester-II
2022-2023

	<p>energy.</p> <p>UNIT V</p> <p>BIOGEOCHEMICAL CYCLES AND NUTRIENT CYCLING:- Carbon cycle; nitrogen cycle; phosphorus cycle; sulphur cycle; hydrological cycle; nutrient cycle models; ecosystem input of nutrients; biotic accumulation; ecosystem losses; nutrient supply and uptake; role of mycorrhizae; decomposition and nutrient release; nutrient use efficiency; nutrient budget; nutrient conservation strategies, Biological invasions :Concept of exotics and invasives; natural spread versus man-induced invasions; characteristics of invaders; stages of invasion; mechanisms of invasions; invasive pathways; impacts of invasion on ecosystem and communities; invasive ecogenomics – role of polyploidy and genome size in determining invasiveness; economic costs of biological invasions.</p>
Course Outcomes	<ul style="list-style-type: none">• The students the basic understanding of ecosystem and its structural and functional aspects.
Text Books	<ol style="list-style-type: none">1. Groom. B. & Jenkins. M. 2000.Global Biodiversity: Earth’s Living Resources in the 21st Century. World Conservation Press, Cambridge, UK.2. Gurevitch, J., Scheiner, S. M., & Fox, G. A. 2002. The Ecology of Plants. Sinauer associates incorporated.
References Books	<ol style="list-style-type: none">1. Loreau, M. &Inchausti, P. 2002. Biodiversity and Ecosystem functioning: Synthesis and Perspectives. Oxford University Press, Oxford, UK.2. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders.3. Pandit, M.K., White, S.M.&Pocock, M.J.O. 2014. The contrasting effects of genome size, chromosome number and ploidy level on plant invasiveness: a global analysis. New Physiologist 203: 697-703.4. Pimentel, D. (Ed.). 2011. Biological invasions: Economic and environmental costs of alien plant, animal, and microbe species. CRC Press.5. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications.6. Wilson, E. O. 1985. The Biological Diversity Crisis. Bioscience 35: 700-706.



Bachelor of Science in Environmental Science
Semester-II
2022-2023

Course Title	CHEMISTRY II: CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY				
Course Code	BSCCH102B				
Course Credits	L	T	P	TC	
	4	-	-	4	
Prerequisites	BASIC CHEMISTRY				
Course Objectives	<ul style="list-style-type: none"> Understand the basic knowledge of chemical energetic, equilibria and functional organic chemistry 				
Course Contents	<p>UNIT I</p> <p>CHEMICAL ENERGETICS:-Review of thermodynamics and the Laws of Thermodynamics, Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchoff's equation, Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.</p> <p>UNIT II</p> <p>CHEMICAL EQUILIBRIUM AND IONIC EQUILIBRIA:-Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG°, Le Chatelier's principle. Relationships between K_p, K_c and K_x for reactions involving ideal gases, Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Acid base theory, Lux-Flud theory, Bronstead-Lowry theory, Arrhenius concepts, HSAB.</p> <p>UNIT III</p> <p>AROMATIC HYDROCARBONS AND ALKYL AND ARYL HALIDES:-Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid., eactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene). Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (S_N1, S_N2 and S_{Ni}) reactions, Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vssubstitution. Aryl Halides Preparation: (Chloro, bromo and iodo-</p>				



Bachelor of Science in Environmental Science
Semester-II
2022-2023

	<p>benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $\text{NaNH}_2/\text{NH}_3$).</p> <p>Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.</p> <p>UNIT IV</p> <p>ALCOHOLS, PHENOLS AND ETHERS (UPTO 5 CARBONS):-Alcohols: Preparation: Preparation of 1°, 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters, Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO_4, acidic dichromate, conc. HNO_3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement, Phenols: (Phenol case) Preparation: Cumenehydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction, Ethers (aliphatic and aromatic): Cleavage of ethers with HI.</p> <p>UNIT V</p> <p>ALDEHYDES AND KETONES (ALIPHATIC AND AROMATIC): (FORMALDEHYDE, ACETALDEHYDE, ACETONE AND BENZALDEHYDE):-Preparation: from acid chlorides and from nitriles. Reactions– Reaction with HCN, ROH, NaHSO_3, NH_2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf-Verley reduction.</p>
Course Outcomes	<ul style="list-style-type: none">• On the completion of this course successfully, student will be able to understand the basics thermo-chemistry, law of chemical equilibrium and preparation and reaction of aldehydes and ketones.
Text Books	<ol style="list-style-type: none">1. Basic Inorganic Chemistry, F.A Cotton, G. Wilkinson and P.L. Gaus, Wiley2. Concise Inorganic Chemistry, J.D. Lee, ELBS



Bachelor of Science in Environmental Science
Semester-II
2022-2023

Reference Books	<ol style="list-style-type: none">3. Concepts of models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J Alexander, John Wiley.4. Mechanism in Organic Chemistry, Sixth Edition, Peter Sykes5. Atkin's Physical Chemistry, University of Oxford.6. Inorganic Chemistry, A.G. Sharp, ELBS.7. Physical Chemistry, Puri, Sharma, Pathania, Vishal Publishing Company.8. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.9. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).10. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).11. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).12. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).13. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
------------------------	---

Course Title	Environmental Science			
Course Code	SSH04212			
Course Credits	L	T	P	Total
	4	-	-	4
Prerequisites	BASIC SCIENCE			
Course Objectives	<p>Upon completion of the course the student shall be able to</p> <ul style="list-style-type: none">• Create the awareness about environmental problems among learners• Impart basic knowledge about the environment and its allied problems.• Develop an attitude of concern for the environment.• Motivate learner to participate in environment protection and environment improvement.• Acquire skills to help the concerned individuals in identifying and solving environmental problems.• Strive to attain harmony with nature.			
Course	UNIT -I			



Bachelor of Science in Environmental Science
Semester-II
2022-2023

Contents	<p>The multidisciplinary nature of environmental studies Definition, scope and importance. Need for public awareness</p> <p>UNIT- II</p> <p>Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.</p> <p>(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.</p> <p>(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.</p> <p>(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. (d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.</p> <p>(d) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.</p> <p>(e) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. · Role of an individual in conservation of natural resources. · Equitable use of resources for sustainable lifestyles.</p> <p>UNIT -III</p> <p>Ecosystems · Concept of an ecosystem · Structure and function of an ecosystem · Producers, consumers and decomposers Energy flow in the ecosystem Ecological succession Food chains, food webs and ecological pyramids Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)</p> <p>UNIT -IV</p> <p>Biodiversity and its conservation · Introduction – Definition: genetic, species and ecosystem diversity · Biogeographical 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 wildlife conflicts · Endangered and endemic species of India · Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity</p> <p>UNIT -V</p> <p>Environmental Pollution Definition · Causes, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear pollution · Solid waste management: Causes, effects and control measures of urban and industrial wastes. · Role of an individual in prevention of pollution · Pollution case studies · Disaster management: floods, earthquake, cyclone and landslides</p>
Course	<ul style="list-style-type: none">• On the Completion of this course successfully student will be able to analyze



Bachelor of Science in Environmental Science
Semester-II
2022-2023

Outcomes	the nature as per the modern scientific context of environmental change.
Text Books	<ol style="list-style-type: none"> 1. Environment and Ecology by Piyush Kant Pandey and Dipti Gupta (Sum India Publication) 2. A Textbook of Environmental Chemistry and Pollution Control by S.S. Dara (S. Chand and Company) 3. Masters, G.M. Introduction to Environment Engineering and Science (Prentice Hall of India). 4. Environmental Chemistry by A.K. Dey (Eastern Ltd.). 5. Environmental Chemistry by B.K. Sharma (Krishna Prakashan).
Reference Books	<ol style="list-style-type: none"> 1. Nebel B.J. Environmental Science (Prentice Hall of India-1987). 2. Environmental Biotechnology by S.N. Jogdand (Himalaya Publishing House). 3. Introduction to Environmental Biotechnology by A.K. Chatterji (Prentice Hall of India).

Course Title	Environmental Lab Course: III			
Course Code	SSH04281			
Course Credits	L	T	P	TC
	-	-	2	2
Course Objectives	<ul style="list-style-type: none"> • To enable the students to develop skills in qualitative and quantitative analysis of water quality parameters 			
Course Contents	<ol style="list-style-type: none"> 1. To determine the acidity of Ground & surface water 2. To determine the alkalinity Ground & surface water. 3. To determine the conductivity and turbidity Ground & surface water. 4. Estimation of Ground & surface water quality parameters (Ph, Temperature, hardness) 5. Estimation of Ground & surface water nitrate. 6. Estimation of Ground & surface water fluoride. 7. Estimation of Ground & surface water arsenic 			



Bachelor of Science in Environmental Science
Semester-II
2022-2023

	8. Estimation of Ground & surface water chlorine 9. Estimation of Ground & surface water cadmium 10. Estimation of Ground & surface water mercury 11. Estimation of Ground & surface water pesticides
Course Outcomes	<ul style="list-style-type: none"> On the Completion of this course successfully student will be able to analyze the water quantity in water bodies
Text And References	1. Pepper, I. L., Gerba, C.P. & Brusseau, M. L. 2006. Environmental and Pollution Science. Elsevier Academic Press 2. Gurjar, B. R., Molina, L. T. & Ojha C. S. P. 2010. Air Pollution: Health and Environmental Impacts. CRC Press, Taylor & Francis

Course Title	Environmental Lab Course: IV				
Course Code	SSH04282				
Course Credits	L	T	P	TC	
	2	-	-	2	
Prerequisites	Preliminary theoretical knowledge of Ecology and Ecosystem				
Course Objectives	<ul style="list-style-type: none"> Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems. 				
Course Contents	<p>Perform any 10</p> <ol style="list-style-type: none"> Study of flora and fauna through charts and maps. Preparation of field report based on the visit to a Wild Life Sanctuary/National Park/Zoo/Biosphere Reserve. Visit to nearby water (pond/river) ecosystem to study biotic and abiotic components. Documentation of biotic and abiotic components of pond/river ecosystem Study of a simple ecosystem (suggested habitats: pond, river, estuarine, grassland, forest and desert) and description of the biotic and abiotic components of the ecosystem. Study of effects of human interaction with natural environment. Survey of vegetation, birds, insects and other animals in an area. Describe the environmental problem of your locality and suggest a remedy 				
Course Outcomes	<ul style="list-style-type: none"> After the practical course, students will be able to differentiate the cells of various living organisms and get awareness of ecosystem, biodiversity, wildlife. Students will be able to observe and correctly identify different 				



Bachelor of Science in Environmental Science
Semester-II
2022-2023

Text books	1. Masters, G.M. Introduction to Environment Engineering and Science (Prentice Hall of India).
References books	1. Environmental Chemistry by A.K. Dey (Eastern Ltd.)

Course Title	Chemistry Lab Course: II			
Course Code	SSH04283			
Course Credits	L	T	P	TC
	-	-	4	4
Prerequisites	Chemistry I Theory			
Course Objectives	<ul style="list-style-type: none">To enable the students to develop skills in inorganic, physical and organic chemistry.			
Course Contents	<ol style="list-style-type: none">Determination of heat capacity of calorimeter for different volumes.Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.Determination of enthalpy of ionization of acetic acid.Determination of integral enthalpy of solution of salts ($\text{KNO}_3, \text{NH}_4\text{Cl}$).Determination of enthalpy of hydration of copper sulphate.Study of the solubility of benzoic acid in water and determination of ΔH.Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.Preparation of buffer solutions:<ol style="list-style-type: none">Sodium acetate-acetic acidAmmonium chloride-ammonium hydroxideTo determine the percentage composition of a binary liquid mixture by viscosity method.To find out the percentage composition of a binary mixture by surface tension method.			
Course Outcomes	On the completion of this course successfully, student will be able to volumetric analysis, physical parameters of drink, soap and preparation of organic molecules and determination of purity.			



Bachelor of Science in Environmental Science
Semester-II
2022-2023

Text Books	<ol style="list-style-type: none">1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
Reference Books	<ol style="list-style-type: none">1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.2. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).3. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry,